Catalogue no. 21-601-M—No. 089
ISSN 1707-0368
ISBN 978-1-100-10370-9

Research Paper

Agriculture and Rural Working Paper Series

Pesticide Use and Pest Management Practices of Canadian Apple Growers

2005

by Martin S. Beaulieu, Statistics Canada
Tim MacDonald, Agriculture and Agri-Food Canada
Charles Benbrook, Benbrook Consulting Services
Pierre Mineau, Environment Canada

Agriculture Division
Jean Talon Building, 12th floor,
170 Tunney's Pasture Driveway
Ottawa, Ontario K1A 0T6

Telephone: 1-800-465-1991

Statistics Canada Statistique Canada

Canada

Statistics Canada
Agriculture Division

Agriculture and Rural Working Paper Series

Pesticide Use and Pest Management Practices of Canadian Apple Growers

2005

August 2008

Catalogue No. 21-601-M

ISSN 1707-0368

ISBN 978-1-100-10370-9

Frequency: Occasional

Ottawa

La version française est disponible sur demande (n° 21-601-M au catalogue)

Published by authority of the Minister responsible for Statistics Canada.

© Minister of Industry, 2008

All rights reserved. The content of this electronic publication may be reproduced, in whole or in part, and by any means, without further permission from Statistics Canada, subject to the following conditions: that it be done solely for the purposes of private study, research, criticism, review or newspaper summary, and/or for non-commercial purposes; and that Statistics Canada be fully acknowledged as follows: Source (or "Adapted from", if appropriate): Statistics Canada, year of publication, name of product, catalogue number, volume and issue numbers, reference period and page(s). Otherwise, no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form, by any means—electronic, mechanical or photocopy—or for any purposes, without prior written permission of Licensing Services, Client Services Division, Statistics Canada, Ontario, Canada K1A 0T6.

The authors would like to thank Stephen Goodacre, Edward Bolton, Leslie Cass and Jeffrey Smith for their useful comments and Thom Dawson, Sheila Young and Josée Rochon for their contribution in the preparation of the results.

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued cooperation and goodwill.

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.ca under "About us" > "Providing services to Canadians."

Symbols

The following standard symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
A	excellent
B	very good
C	good
D	acceptable
^{E}	use with caution
F	too unreliable to be published

Executive summary

Pesticides are used in agriculture to protect against insects, diseases and weeds that either attack the crop or compete for available resources. Although pesticide use is regulated in Canada, little data are collected on how they are actually used. The Crop Protection Survey was a voluntary survey designed to collect baseline data for the first time on quantities and types of pesticide and pest management practices used in 2005. This was a pilot project to determine the feasibility of collecting such information. This paper describes the methods used to collect the data and the process used to produce pesticide-use estimates for all Canadian apple production. Here are some of the major findings:

The majority of growers kept written records of pesticides applied to their orchards.

Growers rely heavily on chemical products to manage and control pests. They reported using pesticides for over 91.8% of total apple producing area.

A total of 924.7 tonnes of active ingredients for all types of pesticide were applied during the 2005 growing season. It is noteworthy that of the 528 tonnes of insecticide active ingredients applied in 2005, 464.7 tonnes (88%) was mineral oil, a low risk product used to prevent build up of pest populations.

Over half (57.1%) of the quantity applied was done to control insects, 40.8% to control diseases and 2.1% to control weeds. The average rate of application for the crop year for all active ingredients was relatively small for herbicides (1.28 kilogram per hectare) compared to 2.41 kilograms per hectare for fungicides and 5.97 kilograms per hectare for insecticides.

Over 90% of the total producing area was treated with insecticides, 86.6% with fungicides and 37.1% with herbicides.

Most of the treated area was either within or below the labelled rate of pesticide application.

Apple producers are diversifying the timing of their insecticide applications and in particular targeting insects at early stages of development when they are often easier to control with limited reliance on broad spectrum, relatively higher-risk insecticides. British Columbia and the Maritime Provinces showed the highest uptake of prevention-based integrated pest management (IPM) systems; Quebec and Ontario, where growers typically face more intense insect pest pressure had the lowest uptake.

The vast majority of the producing area with higher disease pressure was operated by growers planning to use prevention based management practices to control diseases. Practices needed to optimize the benefits of each fungicide application, while minimizing overall use, were adopted on more than two-thirds of the apple producing area. On the other hand, less than one-third of the area was simply sprayed by the calendar, a practice that often needlessly raises grower costs and environmental risks and contributes to the risk of triggering resistance to fungicides among disease pathogens. To manage the most prevalent diseases reported in 2005, growers were more likely to adopt advanced IPM practices than basic practices.

In order to help manage resistance of weeds, insects and disease to pesticides, the practices of reducing pest populations through non-chemical means were used on 35.6% of the producing area.

Canadian apple producers face a significant challenge in managing resistance, given that resistant weeds, insects and plant diseases are already present on about one-third of the producing area.

Table of contents

Executive summary 3
List of figures 5
List of tables 5
List of appendices 6

1 Introduction 7
2 Methodology 8
2.1 Data source 8
2.1.1 Target population 8
2.1.2 Sample selection 8
2.2 Survey coverage 9
2.3 Pest management practices 10
2.4 Pesticide use estimation 10
2.4.1 Treated area 10
2.4.2 Average number of applications 10
2.4.3 Quantities of active ingredients applied 10
2.4.4 Average rates of application 11
2.4.5 Pesticide-use intensity 11
3 Results 11
3.1 Methods of keeping records of pesticide applications 11
3.2 Information kept in record keeping systems 12
3.3 Pesticide application 13
3.4 Pesticide-use intensity 14
3.5 Pesticide spraying practices 16
3.6 Pest management practices 17
3.6.1 Insect incidences and management practices 17
3.6.1.1 Changes in insect incidences 17
3.6.1.2 Responses to greater insect pressure 18
3.6.1.3 Most prevalent insects 19
3.6.1.4 Practices used to control growers' most prevalent insect 20
3.6.2 Disease incidences and management practices 21
3.6.2.1 Changes in disease incidences 21
3.6.2.2 Responses to greater disease pressure 21
3.6.2.3 Most prevalent diseases 22
3.6.2.4 Practices used to control growers' most prevalent disease 23
3.6.3 Weed incidences and management practices 25
3.6.3.1 Changes in weed incidences 25
3.6.3.2 Responses to higher weed pressure 26
3.7 Management practices and pest resistance to pesticides 27
3.7.1 Practices used to manage resistance to pesticides 27
3.7.2 Growers' perception of pests becoming resistant to pesticides 28
4 Conclusion 29

List of figures

Figure 1 Total apple producing area, Canada and provinces, 2005 7
Figure 2 Format used to keep records of pesticides applied, selected provinces, apple producing area, 2005 11
Figure 3 Information kept in record-keeping system, selected provinces, apple producing area, 2005 12
Figure 4 Producing area of apple growers reporting using pesticides, selected provinces, 2005 13
Figure 5 Herbicide-use intensity, selected provinces, apple producing area, 2005 14
Figure 6 Insecticide-use intensity, selected provinces, apple producing area, 2005 15
Figure 7 Fungicide-use intensity, selected provinces, apple producing area, 2005 15
Figure 8 Spraying practices, selected provinces, apple producing area, 2005 16
Figure 9 Insect incidence compared to the last five years, selected provinces, apple producing area, 2005 17
Figure 10 Actions planned to reduce insect problems, selected provinces, apple producing area, 2005 18
Figure 11 Growers reporting they had to deal with new insects, selected provinces, apple producing area, 2005 .. 19
Figure 12 Most prevalent insect, selected provinces, apple producing area, 2005 19
Figure 13 Practices to control the most prevalent insect, selected provinces, apple producing area, 2005 20
Figure 14 Incidences of diseases compared to the last five years, selected provinces, apple producing area, 2005 21
Figure 15 Actions planned to reduce disease problems, selected provinces, apple producing area, 2005 22
Figure 16 Growers reporting they had to deal with new diseases, selected provinces, apple producing area, 2005 22
Figure 17 Most prevalent disease, selected provinces, apple producing area, 2005 23
Figure 18 Tools or methods to make decisions on when to apply fungicides, selected provinces, apple producing area, 2005 24
Figure 19 Practices to control the most prevalent disease, selected provinces, apple producing area, 2005 25
Figure 20 Practices for weed management, selected provinces, apple producing area, 2005 25
Figure 21 Incidences of weeds compared to the last five years, selected provinces, apple producing area, 2005 .. 26
Figure 22 Actions planned to reduce weed problems, selected provinces, apple producing area, 2005 26
Figure 23 Practices used to prevent pest resistance to chemical products, selected provinces, apple producing area, 2005 27
Figure 24 Growers' perception that pests are becoming resistant to pesticides, selected provinces, apple producing area, 2005 28

List of tables

Table 1 Crop Protection Survey coverage, apple production, selected provinces, 2005 9
Table 2 Pesticide use in apple production, selected provinces, 2005 13

List of appendices

Appendix A Statistical tables 30
Table A.1 Format used to keep records of pesticides applied, selected provinces, apple producing area, 2005 30
Table A.2 Information kept in record-keeping system, selected provinces, apple producing area, 2005 30
Table A.3 Pesticide use in apple production, selected provinces, 2005 31
Table A.4 Pesticide use in apple production, Maritime Provinces, 2005 33
Table A.5 Pesticide use in apple production, Quebec, 2005 34
Table A.6 Pesticide use in apple production, Ontario, 2005 35
Table A.7 Pesticide use in apple production, British Columbia, 2005 36
Table A.8 Pesticide-use intensity in apple production, provinces and pesticide types, 2005 37
Table A.9 Pesticide-use intensity in apple production, selected provinces, 2005 38
Table A.10 Pesticide-use intensity in apple production, Maritime Provinces, 2005 40
Table A.11 Pesticide-use intensity in apple production, Quebec, 2005 41
Table A.12 Pesticide-use intensity in apple production, Ontario, 2005 42
Table A.13 Pesticide-use intensity in apple production, British Columbia, 2005 43
Table A.14 Spraying practices, selected provinces, apple producing area, 2005 44
Table A.15 Incidences of insects compared to the last five years, selected provinces, apple producing area, 2005 44
Table A.16 Actions planned to reduce insect problems, selected provinces, apple producing area, 2005 45
Table A.17 Growers reporting they had to deal with new insects, selected provinces, apple producing area, 2005 45
Table A.18 Most prevalent insect reported, selected provinces, apple producing area, 2005 46
Table A.19 Practices to control the most prevalent insect, selected provinces, apple producing area, 2005 47
Table A.20 Incidences of diseases compared to the last five years, selected provinces, apple producing area, 2005 47
Table A.21 Actions planned to reduce disease problems, selected provinces, apple producing area, 2005 48
Table A.22 Growers reporting they had to deal with new diseases, selected provinces, apple producing area, 2005 48
Table A.23 Most prevalent disease, selected provinces, apple producing area, 2005 49
Table A.24 Tools to make decisions on when to apply fungicides, selected provinces, apple producing area, 2005 49
Table A.25 Practices to control the most prevalent disease, selected provinces, apple producing area, 2005 50
Table A.26 Practices for weed management, selected provinces, apple producing area, 2005 50
Table A.27 Incidences of weeds compared to the last five years, selected provinces, apple producing area, 2005 51
Table A.28 Actions planned to reduce weed problems, selected provinces, apple producing area, 2005 51
Table A.29 Practices used to prevent weeds, insects and disease resistance to chemical products, selected provinces, apple producing area, 2005 52
Table A.30 Growers' perception that weeds are becoming resistant to herbicides, selected provinces, apple producing area, 2005 52
Table A.31 Growers' perception that insects are becoming resistant to insecticides, selected provinces, apple producing area, 2005 53
Table A.32 Growers' perception that diseases are becoming resistant to fungicides, selected provinces, apple producing area, 2005 53
Appendix B Questionnaire 54

1 Introduction

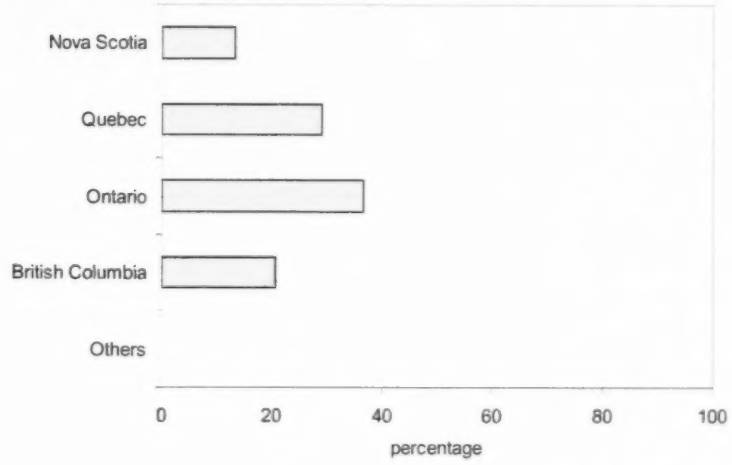
Pesticides are used in agriculture to protect against insects, diseases and weeds that either attack the crop or compete for available resources. Pesticides are regulated in Canada by the Pest Control Products Act, which is administered by the Pest Management Regulatory Agency (PMRA) of Health Canada. Before they can be used in Canada, pesticides are evaluated against strict scientific criteria. The evaluation takes into consideration exposure and toxicity of the pesticides to humans and the environment, as well as the effectiveness of the pesticide for its intended purpose. Only pesticides that meet the standards set by the regulator are registered for use in Canada.

Although pesticide use is regulated in Canada, little data are collected on how they are actually used. Agriculture and Agri-Food Canada, in collaboration with PMRA, is working with agricultural stakeholders to reduce pesticide risks by assisting the development and adoption of lower risk pesticides and pest management practices. Questions that need to be answered before pesticide risks can be reduced include: How much pesticide is used? How is it applied? When is it applied? On what crop is it applied? What pest is being controlled? What pest population thresholds are used to trigger an application?

The Crop Protection Survey was designed and tested to collect data on these questions from apple, carrot and grape growers in Canada as a pilot project to determine the feasibility of collecting such information.

In Canada, apples are grown in areas where warm summers are complemented by mild winters. Major production areas include Ontario, Quebec, British Columbia and Nova Scotia which totalled 97.8% of the total producing area (Figure 1).

Figure 1 Total apple producing area, Canada and provinces, 2005



Source: Statistics Canada, Fruit and Vegetable Survey.

This paper describes the methods used to collect the data and the process used to produce pesticide-use estimates for all Canadian apple production. This is followed by a presentation of the results, including tables, graphs and discussion.

Section 2 describes the methodology. Section 3 presents the survey results. Sections 3.1 to 3.4 report results for pesticide use on selected orchards for the calendar year 2005, including how records were kept, how was made the decision to apply specific products, when, how and how much of each specific product was applied.

Sections 3.5 and 3.6 present information on spraying practices: weed, insect and plant disease pest management practices: and the most prevalent targeted weed, insect or plant disease. Also presented is the prevalence of pest pressures in 2005 compared to the previous five years.

Section 3.7 presents results about the perceived presence of possibly resistant pests.

Detailed statistical tables are included in Appendix A. The survey questionnaire is included in Appendix B.

2 Methodology

2.1 Data source

Results are based on the 2005 pilot survey on crop protection. This voluntary survey was designed to collect baseline data for the first time on quantities and types of pesticide and pest management practices used in 2005. This survey was conducted for Agriculture and Agri-Food Canada (AAFC), Environment Canada (EC) and Health Canada (HC). A total of 572 apple producers voluntarily participated in the survey conducted by Statistics Canada from January to March 2006. Growers provided information on their use of pesticides and other pest management practices during the 2005 growing season. Producers were asked to complete the survey with the help of a trained interviewer on the premises of farm operations. Surveying took place from the beginning of January to the end of March 2006. The survey questionnaire is presented in Appendix B.

The first two sections of the survey recorded information on the location, farm size, area devoted to apple production, varieties grown and orchard history. Most surveyed farms grew apples in more than one orchard and some operated a dozen or more. To reduce response burden and the time to complete the survey, one orchard was randomly selected from up to ten of the largest orchards operated by the farmer. All subsequent questions on pesticide use and pest management practices focused on this single orchard.

The survey was well received with an overall response rate of 89.9%.

2.1.1 Target population

The target population consisted of all active farms in Canada with sales of $10,000 or more reported to the 2001 Census of Agriculture, which contributed to the top 95% of the total acreage of apple. Operational constraints led to the exclusion of certain types of farms: institutional farms (prisons, research stations, colleges), farms located on Indian reserves, small farms that contributed to the lowest 5% of the total acreage of each type of crop in each region, remote farms that could not be visited by interviewers within reasonable traveling distance and cost; and farms located in the Prairie Provinces, the Yukon, the Northwest Territories and Nunavut.

2.1.2 Sample selection

The survey frame consisted of the list of all active farms from the 2001 Census of Agriculture, updated with the acreages of apple operations for the subset of farm operations that also responded to the 2003, 2004 and 2005 Fruit and Vegetable Survey. The survey frame was divided into groups, or strata, defined by region and by size of operation based on acreage (large, medium and small operations).

Farms were randomly selected within each stratum. Large farms that contributed to a significant proportion of the provincial total apple area were all included in the sample. These farms were assigned a weight of one and thus represented no other farms in the target population but themselves.

A random sample of the medium and small farms was selected. These farms were assigned a weight greater than one since they represented other farms with similar characteristics.

Furthermore, each selected orchard had a specific weight based on the probability of a farm being selected for the sample and the proportion of the selected orchard compared to the total producing area of the selected farm. Weights were adjusted after data collection for non-response and they were used to estimate results to the target population.

2.2 Survey coverage

The survey was designed to cover 95% of the total producing area in each region (Maritime Provinces, Quebec, Ontario and British Columbia). Table 1 shows how representative the results are in terms of number of operations and producing area compared with results of the 2006 Census of Agriculture and the 2005 Fruit and Vegetable Survey. Overall, the Crop Protection Survey represented 37.0% of all apple growers in Canada. In terms of producing area, the survey covered 88.1%. The growers who reported using pesticides represented 86.5% of the total producing area. The questionnaires with valid and usable information about pesticide application accounted for 81.7% of all producing area and the selected orchards represented almost half of the total producing area.

Table 1 Crop Protection Survey coverage, apple production, selected provinces, 2005

Data sources and coverage	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
Farms reporting			number		
2006 Census of Agriculture	324	741	1,223	1,771	4,190
2005 Fruit and Vegetable Survey	.	.	.	.	.
2005 Crop Protection Survey	132	368	394	656	1,551
Farms reporting using pesticides	131	365	390	605	1,491
Farms with valid pesticide use data	131	326	380	580	1,418
Producing and non-producing area			hectares		
2006 Census of Agriculture	2,847	6,541	8,162	4,470	22,101
2005 Fruit and Vegetable Survey	2,788	6,515	7,568	4,654	21,586
2005 Crop Protection Survey	2,723	5,231	8,037	4,325	20,316
Producing area			hectares		
2006 Census of Agriculture	.	.	.	.	.
2005 Fruit and Vegetable Survey	2,559	5,564	7,001	3,925	19,087
2005 Crop Protection Survey	2,489	4,711	6,187	3,421	16,808
Farms reporting using pesticides	2,439	4,697	6,179	3,196	16,510
Farms with valid pesticide use data	2,439	4,070	6,119	2,973	15,601
Selected orchard	714	3,324	3,026	2,168	9,232
Crop Protection Survey coverage			percentage[1]		
Number of reporting farms	40.9	49.7	32.3	37.1	37.0
Apple producing area	97.3	84.7	88.4	87.2	88.1
Farms reporting using pesticides	95.3	84.4	88.3	81.4	86.5
Farms with valid pesticide use data	95.3	73.1	87.4	75.7	81.7
Selected orchard	27.9	59.7	43.2	55.2	48.4

Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
1. Crop Protection Survey weighted estimates are compared with the 2005 Fruit and Vegetable Survey for the area and the 2006 Census of Agriculture for the number of farms.
Source: Statistics Canada, 2006 Census of Agriculture, 2005 Fruit and Vegetable Survey, 2005 Crop Protection Survey.

2.3 Pest management practices

A series of questions was asked about pest management practices used by apple growers on the selected orchards. Respondents were asked to identify the targeted pests, practices used to deal with the problems, expertise and information used for decision making, the basis for application decisions and whether pest pressure had changed over the last five years. Growers facing greater pest pressure were asked what they were planning to do in the next growing season to reduce the problem. Where applicable, the practices were grouped into two categories: dependent practices relying more on the use of pesticides (pesticide dependent practices) and those focusing more on prevention (integrated pest management practices).

To get a better idea of the uptake or importance of the adoption of the different practices[1], each answer was expressed into the producing area covered by multiplying the area of the selected orchard by its survey weight to estimate results to the target population. One limitation of this approach is the assumption that the grower who adopted a specific practice in the selected orchard also adopted this practice to all the other orchards that the grower operated.

2.4 Pesticide use estimation

The following section describes the different statistics related to pesticide-use estimates.

2.4.1 Treated area

For each combination of selected orchard and product application (or active ingredient)[2], the treated area was estimated using the total orchard area times the percentage of the orchard area treated. For each possible combination, the application used on the largest treated area was then retained as the maximum area treated over the growing season. The maximum treated area was then multiplied by the selected orchards' survey weight[3]. The total treated area was then calculated by summing up the weighted maximum area treated of all selected orchards for each active ingredient.

$$Treated_area = \sum_{f=1}^{F} Max_{a=1}^{A} (Percent_Area_a) \times WeightF_f$$

where *WeightF* is the survey weight of the selected orchard *f*; *Percent_Area* is the selected orchard area times the percent of the area that was treated during a single application *a*; *Max* is for the maximum value of percent area among all application (a) on the selected orchard; and *f* is the fth selected orchard in the survey sample.

2.4.2 Average number of applications

For each combination of selected orchard and active ingredient, the average number of applications was derived by adding the treated area of all applications over the growing season (or cumulative treated area) divided by the maximum area treated. A weighted average[4] of all selected orchards surveyed was then calculated for each active ingredient.

2.4.3 Quantities of active ingredients applied

For each application, the quantity of active ingredient was calculated by multiplying the treated area by the normalized reported rate of application5. For each combination of selected orchard-active ingredient, the total quantity used was derived by adding up the quantity calculated for all applications over the growing season. These totals for each combination of selected orchard-active ingredient were then multiplied by the specific

1. Counts of growers reporting a practice would not give a complete picture on the adoption of this practice as growers operate orchards of different sizes. For example, a practice may be significant in terms of the number of growers adopting it. However, if the majority operated small orchards, its importance may be much less significant once expressed in terms of the producing area covered by this practice.
2. Each active ingredient was considered as one application for products that contain more than one active ingredien.
3. Refer to section 2.1.2 for survey weight explanation. These weights were used to extrapolate results to the whole target population.
4. Selected orchard weights adjust average to take into account the size of different selected orchards.
5. Expressed in kilograms of active ingredient per hectare. Products in liquid form were converted into kilograms per hectare using percentage of guaranteed active ingredient and specific gravity.

selected orchard survey weight. The quantities for each active ingredient were then calculated by adding up the quantities for all selected orchards.

2.4.4 Average rates of application

For each combination of selected orchard and active ingredient, the cumulative treated area was estimated by summing up all treated areas over the growing season. The cumulative treated area was then multiplied by the selected orchard survey weight. For each active ingredient, the average rate of application was then estimated by dividing the total quantity of active ingredient applied (as calculated in 2.4.3) by the cumulative area treated.

2.4.5 Pesticide-use intensity

For each combination of selected orchard and active ingredient, the treated area was qualified as being below, within or above the labelled rate of application (three intensity categories). The totals for each combination of selected orchard-active ingredient-intensity category were then multiplied by the selected orchard survey weight. The treated area for each active ingredient was then calculated by adding up the treated area in each intensity category for all selected orchards. For each active ingredient, pesticide-use intensity was then expressed in percentage by dividing the total treated area by the cumulative treated area for each category.

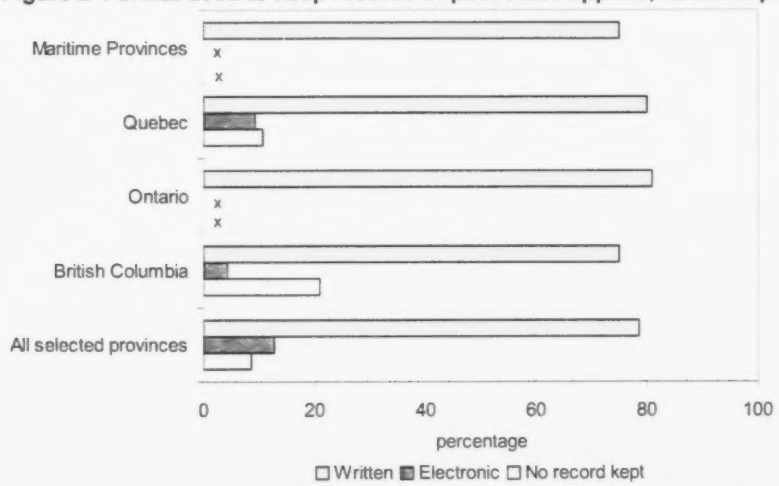
3 Results

This section highlights significant findings related to the use of pesticides and other pest management practices used by apple growers in 2005. Detailed statistical tables are included in Appendix A.

3.1 Methods of keeping records of pesticide applications

Written records were kept on over three-quarters (78.7%) of the producing area (Figure 2), while 12.8% of the producing area had electronic records kept. No records were kept for 8.6% of the producing area. Regional differences were apparent, with British Columbia having the largest producing area (20.8%) with no records kept.

Figure 2 Format used to keep records of pesticides applied, selected provinces, apple producing area, 2005

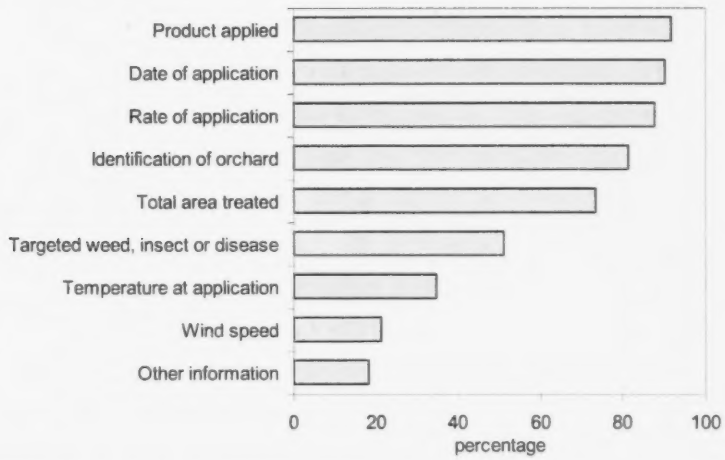


Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.2 Information kept in record keeping systems

For most of the producing area, records were kept for the product applied (91.9% of total producing area), the date of application (90.2%) and the rate of application (87.7%) (Figure 3). Targeted weed, insect or plant disease was recorded for just over half of the producing area. There were no significant regional differences with respect to the type of information recorded.

Figure 3 Information kept in record-keeping system, selected provinces, apple producing area, 2005

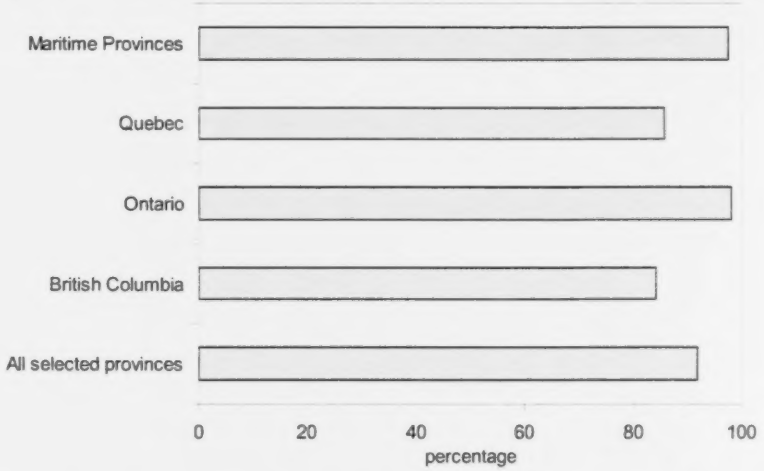


Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.3 Pesticide application

Pesticides are important pest management tools for growers, as demonstrated in Figure 4 (Tables A.3 to A.7, Appendix A). For all selected provinces, growers reported using pesticides on over 91.8% of the total apple producing area. This proportion reached over 97% in the Maritime Provinces and Ontario, while it was 84.2% in British Columbia and 86.0% in Quebec. A limitation of these data is that organic farmers using strictly non-chemical pest control methods were not specifically identified in the sample selection prior to data collection. It is likely that organic growers were under-represented in this pilot survey.

Figure 4 Producing area of apple growers reporting using pesticides, selected provinces, 2005



Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

A total of 924.7 tonnes of active ingredients included in insecticides, herbicides and fungicides were applied during the 2005 growing season on apple producing area. Over half (57.1%) of this total was applied to control insects, 40.8% to control diseases and 2.1% to control weeds.

Over 90% of the producing area was treated with insecticides, 86.6% with fungicides and 37.1% with herbicides. On average, insecticides and herbicides were applied 1.5 times during the season, while fungicides were applied more often (3.5 applications). The average rate of application for the crop year for all active ingredients was relatively small for herbicides (1.28 kilogram per hectare) compared to 2.41 kilograms per hectare for fungicides and 5.97 kilograms per hectare for insecticides (Table 3). Detailed information by province and active ingredient is presented in Appendix A, Tables A.3 to A.7.

Table 2 Pesticide use in apple production, selected provinces, 2005

Pesticide types	Farms reporting	Treated area		Average application	Average rate of application	Quantity applied
	number	hectare	percentage[1]	number	kilograms per hectare	kilograms
Total herbicides, insecticides and fungicides	1,401	15,436	91.8	2.2	3.55	924,732
Herbicides	766	6,231	37.1	1.5	1.28	19,060
Insecticides	1,375	15,206	90.5	1.4	5.97	528,122
Fungicides	1,303	14,563	86.6	3.5	2.41	377,550

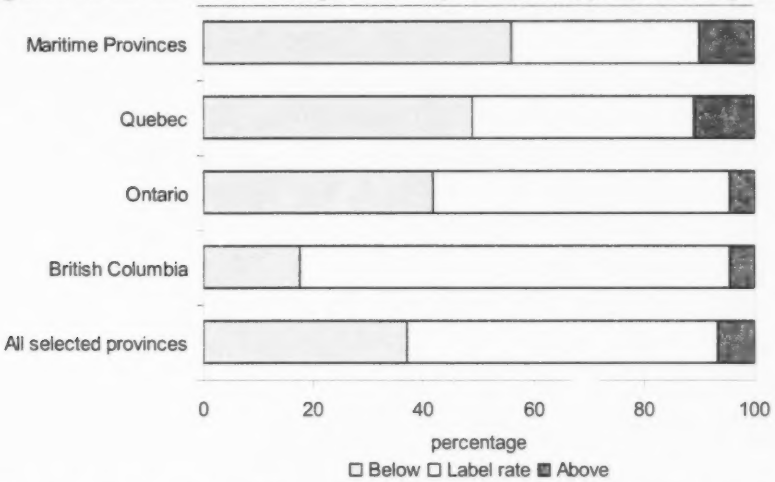
Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
1. Percentage of total apple producing area.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.4 Pesticide-use intensity

The following figures show that overall, most of the treated area was either within or below the labelled rate of application. No attempt was made to identify factors such as a severe insect, disease or weed infestation which may help to explain why a small portion of growers used a rate higher than the labelled rate. This type of analysis was beyond the scope of this report, but could be conducted in future research.

Figure 5 shows that most herbicide treatments (93.3%) were within or below the labelled rate of application. There was no significant difference across regions.

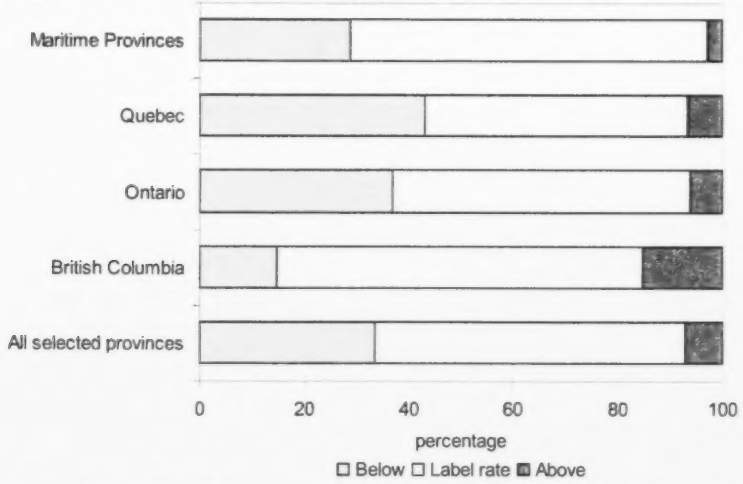
Figure 5 Herbicide-use intensity, selected provinces, apple producing area, 2005



Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Percentage of cumulative treated area.
Source: Statistics Canada, 2005 Crop Protection Survey.

Similarly, for insecticides, Figure 6 shows that 92.8% of insecticide treatments were within or below the labelled rate of application. There was a small difference across regions, with 15.4% of the insecticide treatments in British Columbia being higher than the labelled rate (Appendix A, Table A.13).

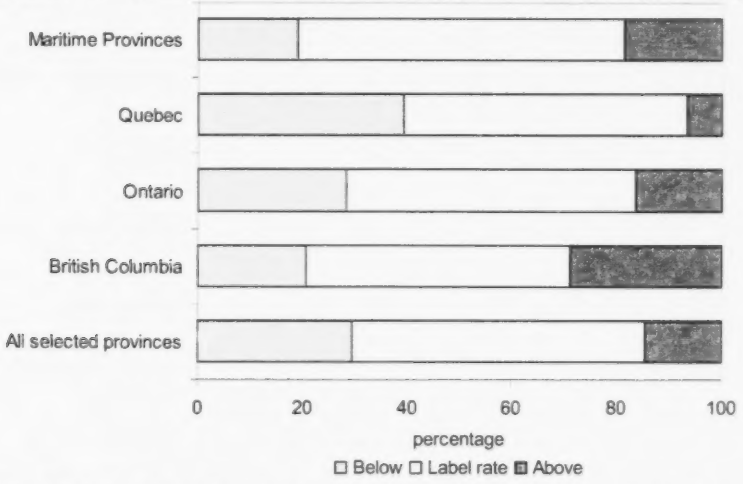
Figure 6 Insecticide-use intensity, selected provinces, apple producing area, 2005



Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Percentage of cumulative treated area.
Source: Statistics Canada, 2005 Crop Protection Survey.

Figure 7 shows that most of the apple fungicide treatments (85.4%) were within or below the labelled rate of application. There were some significant differences across regions. In British Columbia, close to one-third (29.0%) of the fungicide treatments were above the labelled rate of application, while Quebec had the lowest percentage of fungicide treatments that were higher than labelled rates (6.6%).

Figure 7 Fungicide-use intensity, selected provinces, apple producing area, 2005



Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Percentage of cumulative treated area.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.5 Pesticide spraying practices

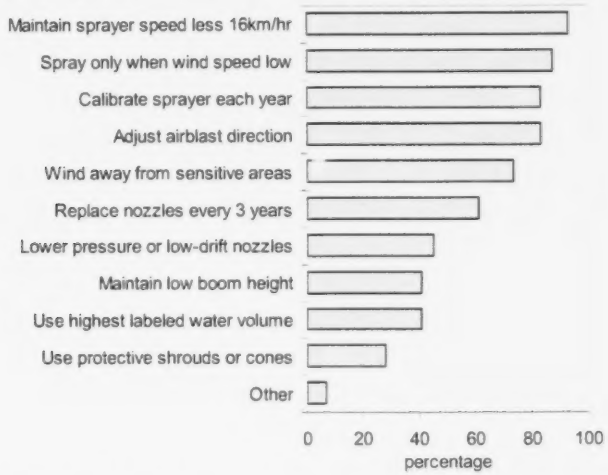
Pesticide spraying practices have an impact on how much of the pesticide applied reaches the intended targeted pests. In the survey, growers were given a list of practices that are commonly recommended as ways to reduce spray drift and increase the precision of applications. The list included five practices dealing with sprayer maintenance and design (e.g., use of shrouds or cones to direct sprays, replacing the nozzle every three years) and five practices dealing with how sprayers are used (e.g., sprayer speed, wind direction). Respondents were instructed to check all the practices used.

Growers indicated that six of these practices were used on 60% or more of the apple producing area, with four of these being used on 80% or more of the producing area. The adoption of advanced low-drift spray equipment and maintenance practices was lower, with two of the five practices being used on less than half the producing area. These practices are relatively more costly and growers may not see the short-term payoff in using these practices (Figure 8).

Among the specific practices used in the majority of spray operations, sprayers were operated at less than 16 km/hour on 93.2% of the producing area, 87.8% of the apple producing area was sprayed only when wind speeds were low and airblast direction was adjusted for targeted height on 83.3% of the apple area.

As shown in Appendix A Table A.14, producers in British Columbia were less likely to calibrate sprayers annually (67.2% of growers practiced annual calibration in British Columbia) than farmers in other provinces, likely reflecting differences in the total number of applications and pesticide expenditures. The relatively higher percentage of high-density orchards planted to dwarf trees in British Columbia allow growers to use low boom height sprayers on almost 78.6% of apple hectares, compared to less than 37.3% of hectares in the other provinces.

Figure 8 Spraying practices, selected provinces, apple producing area, 2005



Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.6 Pest management practices

Canadian consumers expect high quality produce. This high quality produce is partly achieved by controlling crop pests. The most common tools available are pesticides, which include herbicides to control weeds, fungicides to control diseases and insecticides to control insects. Pesticides provide immediate results in a cost effective way. Growers make the best use of this pest management tool by applying the right amount, by timing their applications at specific pest development stages, by using different products in combination, or switching and rotating the family of products used over time. These practices will be referred to in this section as pesticide dependent practices.

Other tools are used by growers to control crop pests. Some more obvious tools include selecting pest resistant crop varieties and disease free stock. Other practices are less common, such as altering fertilizer or irrigation water levels and releasing or attracting beneficial organisms. These management practices have to be planned out and results may not be apparent for a couple of years. These practices will be referred to as prevention based practices.

3.6.1 Insect incidences and management practices

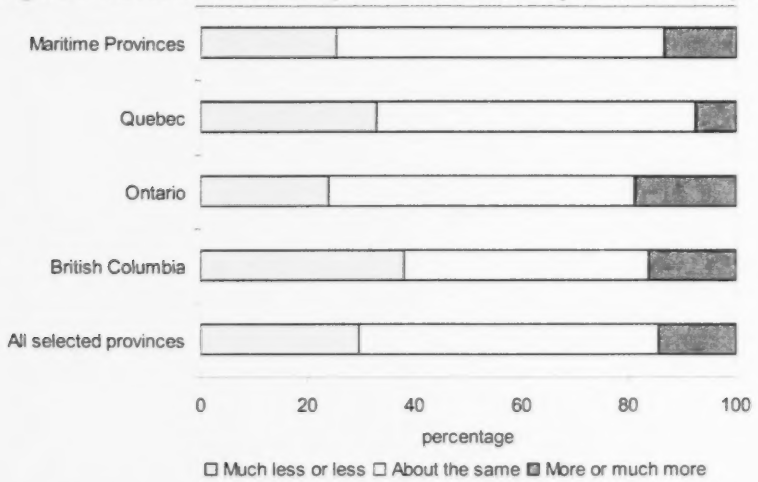
This section highlights results related to the incidence of insects and the management practices used by apple growers to control them.

3.6.1.1 Changes in insect incidences

Insect pest pressure varies from year to year and from region to region. Growers were asked if insects in 2005 were more, less or about equally prevalent, compared to the last five years. For the 2005 growing season, insect pressure was reported as "about the same" on 56.1% of the apple producing area (Figure 9). Insects were "much less or less" prevalent than in recent years on 29.6% of the producing area and "more or much more" prevalent on 14.3% of the producing area.

More than 90% of the producing area in Quebec had insect pest pressure that was either lower than or the same as the last five years. In contrast, a significant amount of the producing area in Ontario (18.8%) and in British Columbia (16.3%) experienced insect pest pressure that was higher than it had been in the last five years (Appendix A, Table A.15).

Figure 9 Insect incidence compared to the last five years, selected provinces, apple producing area, 2005



Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.6.1.2 Responses to greater insect pressure

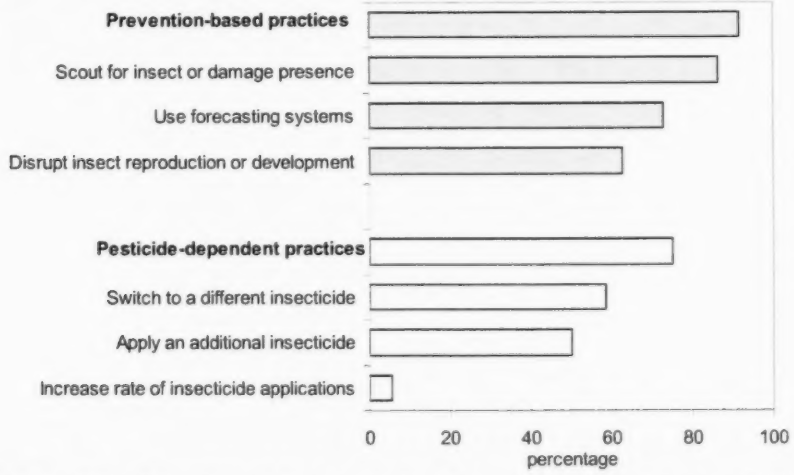
Growers operating the orchards with "more or much more" insect pest pressure were asked what they plan to do in the next growing season in the hope of reducing their insect problems. Six practices were proposed, along with a box to identify "other" practices. Growers were instructed to check all the practices they planned to use.

Three of the listed practices involved more effective use and greater reliance on insecticides. Growers reported that on just under 60% of the producing area with greater insect pressure they plan to use two of the three pesticide-dependent actions (switch to a different insecticide, make an additional application), while 5.7% of the producing area would include a plan to increase rates of application (Figure 10).

Three other listed practices involved prevention-based integrated pest management (IPM) practices: scouting, use of forecasting systems and disruption of insect reproduction or development. Using these practices, growers know when insecticides need to be used and money is not wasted on needless applications. Growers reported plans to use two of these three tactics on more than 72% of the producing area with greater insect pressure and the third practice of disrupting insect reproduction or development on 62.9% of the producing area.

On almost the entire producing area (91.7%) operated by growers reporting to have "more" or "much more" insect problems compared to the last five years, growers planned to use prevention based practices in the future whereas 50% of this area was operated by growers who planned to apply an additional insecticide treatment to deal with future insect problems. Very little of the producing area under intense insect pressure was operated by growers who planned to increase rates of insecticide application in order to reduce insect problems in the future.

Figure 10 Actions planned to reduce insect problems, selected provinces, apple producing area, 2005

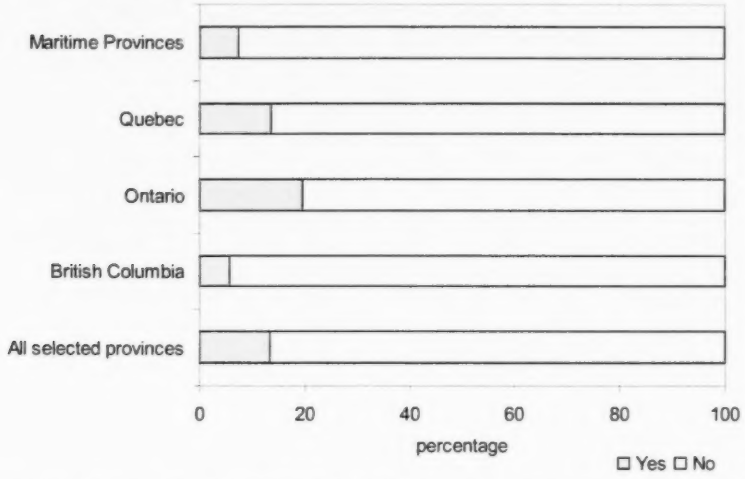


Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
For farms that reported having "more" or "much more" insect problems compared to the last five years.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.6.1.3 Most prevalent insects

Very few growers in Canada had to deal with a new insect pest in 2005 (Figure 11). Ontario had the highest incidence of new pests reported (14.3% of the producing area), while British Columbia and the Maritime Provinces had the lowest incidences (less than 8% of producing area).

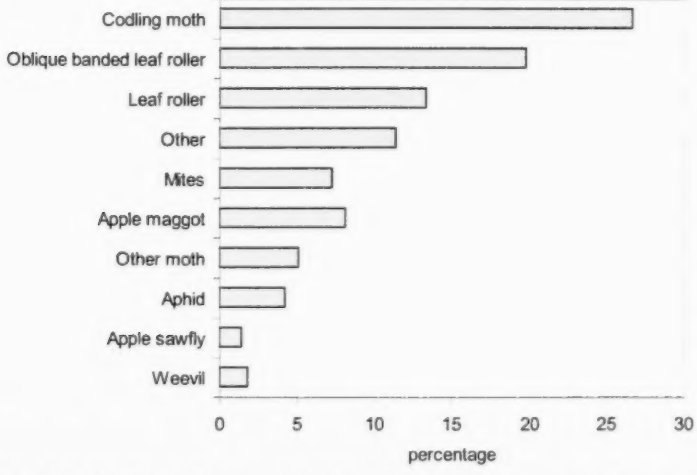
Figure 11 Growers reporting they had to deal with new insects, selected provinces, apple producing area, 2005



Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

The most prevalent insects that apple growers had to control on selected orchards in 2005 were the codling moth (mainly in British Columbia and the Maritime Provinces) and the oblique banded leaf roller (in Ontario and Quebec) (Figure 12 and Appendix A, Table A.18).

Figure 12 Most prevalent insect, selected provinces, apple producing area, 2005



Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.6.1.4 Practices used to control growers' most prevalent insect

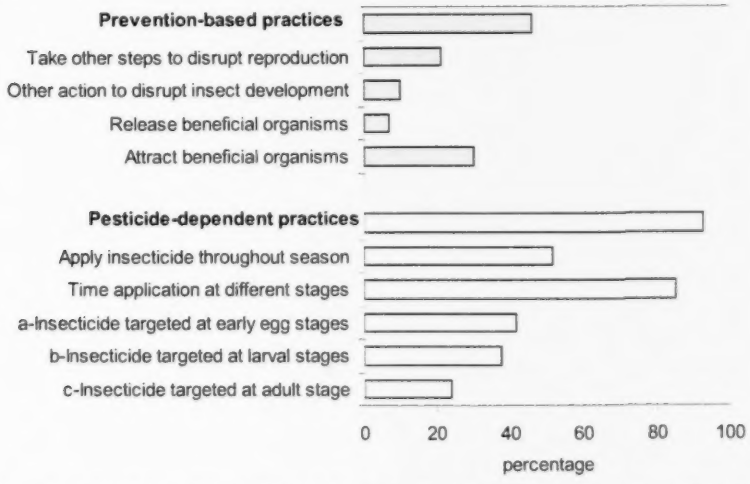
Growers were asked to indicate from a list of six practices the ones that they used to control their most prevalent insect. Two of the practices were dependent on pesticides and were related to the timing of applications, while the other four practices were prevention-based and reflect a commitment on the part of the grower to use biologically-based, IPM control methods. Timing insecticide applications at specific life stages of their most prevalent apple insect was used on 92.9% of the producing area. Prevention-based practices were used on 46.4% of producing area. Thirty percent of the producing area was operated with growers making attempts to attract beneficial insects, while 6.7% of the producing area had beneficial organisms released in an attempt to control the most prevalent insect (Figure 13).

More than 85.3% of the apple orchard area was treated with an insecticide at specific, targeted times during the growing season to manage the orchard's most prevalent insect. Just over half of the producing area was sprayed at different times throughout the growing season for the same pest.

These results show that apple producers are diversifying the timing of their insecticide applications and in particular, targeting insects at early stages of development when they are often easier to control with limited reliance on broad spectrum, relatively higher-risk insecticides. Over 37% of the producing area was sprayed with a product targeting early nymphs or eggs, or treated with an insecticide that disrupts larval or nymph development. Insecticides were sprayed to control adult insects on 24.0% of the producing area.

Overall, data show that growers in British Columbia and in the Maritime Provinces are more likely to use prevention-based IPM systems than the Central Provinces, where growers typically face more intense insect pest pressure. Growers deployed one or more of these four practices on more than half of the producing area in the Maritime Provinces and British Columbia (Appendix A, Table A.19). Furthermore, producers in British Columbia used each of the four practices on 19% or more of the producing area, including mating disruption on 47.0%. In the Maritime Provinces, growers taking steps to attract beneficial organisms used this practice on 40.8% of their producing area.

Figure 13 Practices to control the most prevalent insect, selected provinces, apple producing area, 2005



Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
For farms that reported having a significant insect problem.
Source: Statistics Canada, 2005 Crop Protection Survey.

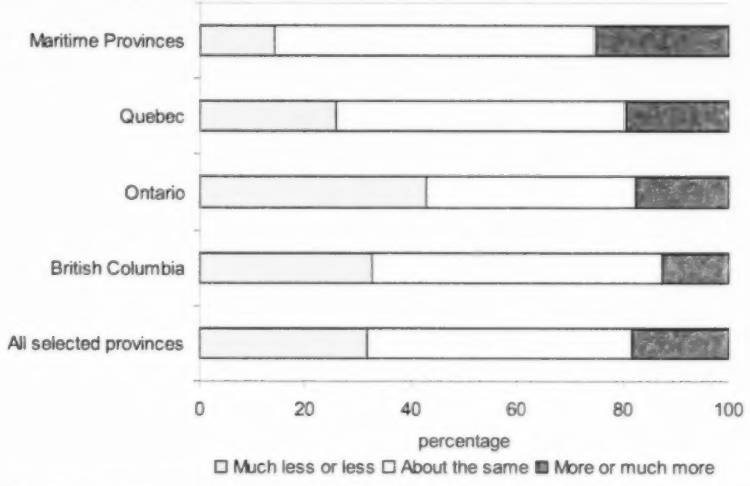
3.6.2 Disease incidences and management practices

3.6.2.1 Changes in disease incidences

Growers were asked if diseases in 2005 were more, less or about equally prevalent, as compared to the last five years. On half the producing area, growers reported that the incidence of disease (fungus, bacteria and mildew) was "about the same" in 2005 compared to the last five years. Prevalence was "much less or less" on 31.8% of the producing area and "more or much more" on 18.2% of the producing area (Figure 14).

Disease pressure was significantly higher in the Maritime Provinces for one-quarter of the producing area. Forty three percent of the producing area in Ontario had less disease pressure than in previous years.

Figure 14 Incidences of diseases compared to the last five years, selected provinces, apple producing area, 2005



Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

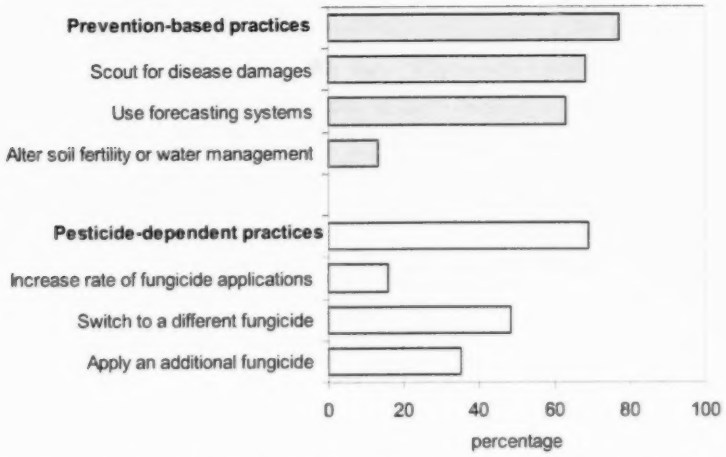
3.6.2.2 Responses to greater disease pressure

Growers who faced "more or much more" disease were asked to choose from a list of practices that they planned to do to help reduce disease problems during the next growing season. Three of the listed practices related to better use of fungicides and three related to prevention-based management practices.

Over three-quarters (77.5%) of the producing area with more disease pressure was operated by growers who planned to use prevention-based management practices to control diseases. More than 63% of the producing area was operated by growers who planned to use forecasting systems or scouting in order to help control disease damage in the future. Altering soil fertility or water management was chosen less frequently as a practice that would reduce disease pressure, with 13.4% of the producing area where growers had plans for these practices (Figure 15).

For nearly half of the producing area, growers planned to switch to a different fungicide and for 35.3% of the producing area, growers planned to apply an additional fungicide to deal with future disease problems. About 15.9% of the producing area was planned for increased fungicide rates of application. Quebec growers stand out as a group that planned to use less pesticide-dependent practices and planned to rely more heavily on prevention-based practices as compared with the other provinces. (Appendix A, Table A.21).

Figure 15 Actions planned to reduce disease problems, selected provinces, apple producing area, 2005

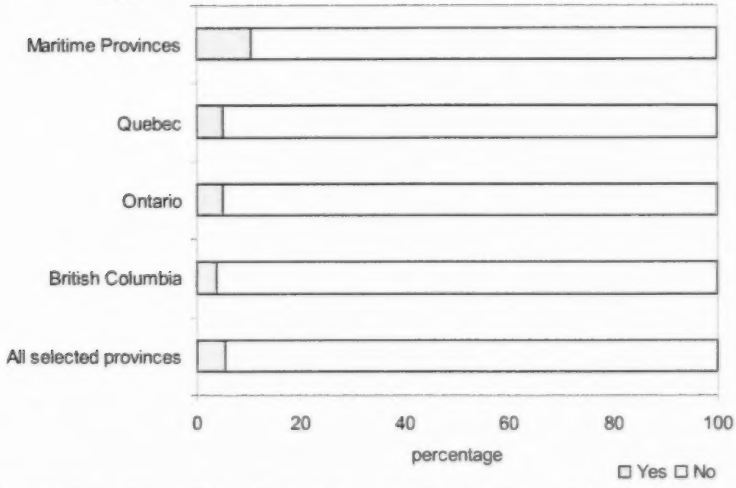


Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
For farms that reported having "more" or "much more" disease problems compared to the last five years.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.6.2.3 Most prevalent diseases

Growers reported new plant diseases on 5.6% of the producing area in 2005 (Figure 16).

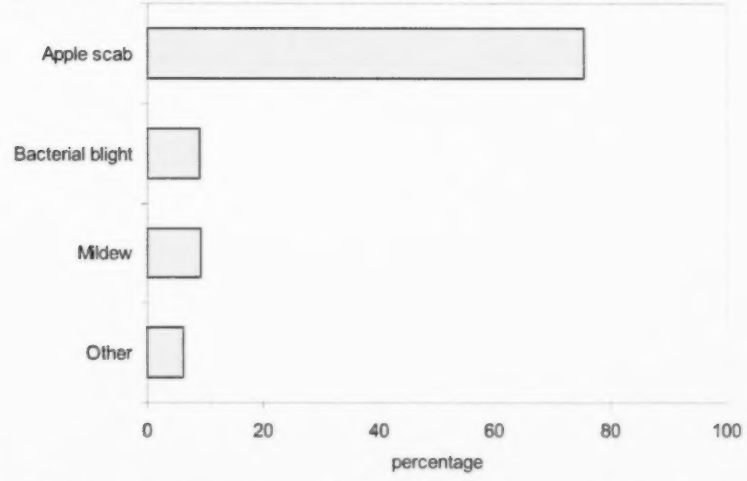
Figure 16 Growers reporting they had to deal with new diseases, selected provinces, apple producing area, 2005



Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Apple scab, bacterial blight and mildew were the most prevalent diseases reported (Figure 17). By far the most prevalent disease reported was apple scab, which was a far bigger challenge in the Eastern provinces compared to British Columbia. This is likely due to climatic differences (Appendix A, Table A.23).

Figure 17 Most prevalent disease, selected provinces, apple producing area, 2005



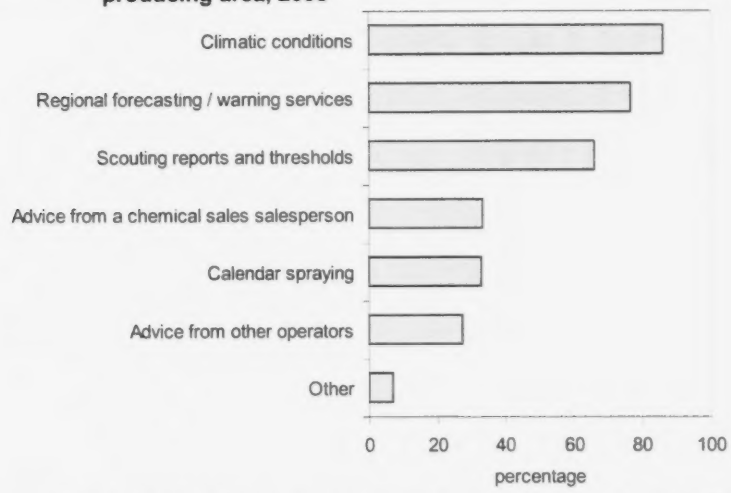
Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.6.2.4 Practices used to control growers' most prevalent disease

All growers were asked to report tools or methods they or their advisors use to make decisions on when to apply fungicides to control their most prevalent disease. Six tools were listed along with a box to identify "other" practices. Growers were instructed to check all the tools they used.

Eighty six percent of the producing area was operated by growers who considered climatic conditions when making decisions about when to apply fungicides (Figure 18). Very few growers made decisions with the help of agricultural consultants (represented 7.0% of the producing area and accounted for nearly all of the "Other" answers). Practices needed to optimize the benefits of each fungicide application, while minimizing overall use, were adopted on more than two-thirds of the producing area (scouting and using forecasting models). Just under one-third of the producing area was sprayed on a fixed schedule (calendar spraying), a practice that often raises growers' costs and environmental risks and can contribute to the risk of triggering resistance to fungicides among disease pathogens.

Figure 18 Tools or methods to make decisions on when to apply fungicides, selected provinces, apple producing area, 2005



Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
For farms that reported having a significant disease problem.
Source: Statistics Canada, 2005 Crop Protection Survey.

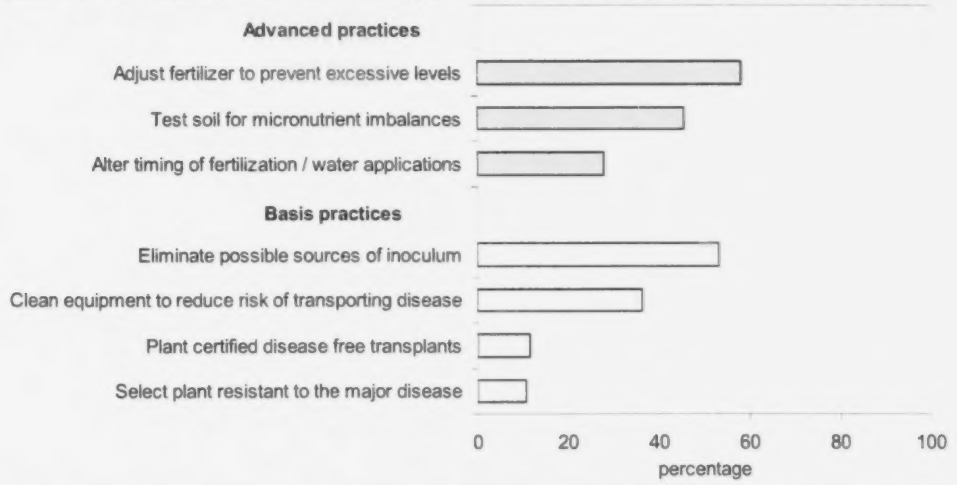
Growers were given a list of four basic IPM practices and three advanced IPM practices that are indicative of a heavy emphasis on prevention. They were asked to identify which practices they use to control their most prevalent disease.

Disease on 53.2% of the producing area was managed by growers making efforts to eliminate possible sources of disease inoculum, such as removing cull piles and pruning trees and host plants in nearby fields. Just under 37% of the producing area was managed with growers cleaning their equipment to reduce the risk of disease transport between locations (Figure 19). These basic IPM practices are recommended in all orchards, particularly in areas where plant diseases trigger the need for multiple fungicide applications, as is the case in the Ontario, Quebec and the Maritime Provinces.

The three more advanced IPM practices involve management of fertilizer rates and water applications to avoid either nutrient excesses (that can trigger a spike in disease organism populations), or impair plant defense responses (testing soil for micronutrients). Approximately 60% of the producing area was managed by growers who adjusted fertilizer rates to prevent excessive levels of nutrients in the root or foliage that could result in more disease. The soil was tested for micronutrient imbalances on 45.6% of the producing area. The degree of adoption of these practices shows that growers are willing to build more advanced preventive practices into their disease management systems.

Very few growers reported considering disease resistance or transplant disease when planting new trees. Only 11.6% of the producing area was planted with disease-free rootstock and 10.7% of the producing area was planted with a variety that had resistance to the most prevalent disease threat. This low percentage reflects the fact that many orchards were planted years ago when the most prevalent diseases were different.

Figure 19 Practices to control the most prevalent disease, selected provinces, apple producing area, 2005

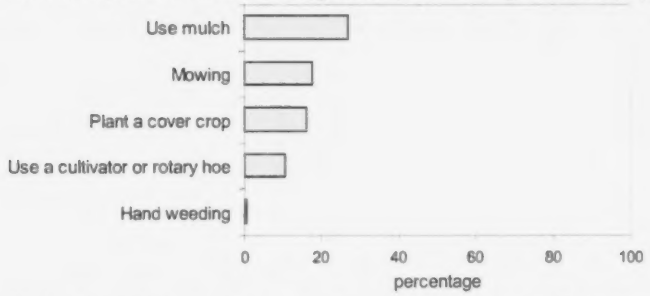


Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
For farms that reported having a significant disease problem.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.6.3 Weed incidences and management practices

To manage weeds, apple growers reported mulching as the most common practice used on 27.1% of the producing area. By far the most common "other" method was mowing, which was used on 17.8% of the producing area (Figure 20).

Figure 20 Practices for weed management, selected provinces, apple producing area, 2005



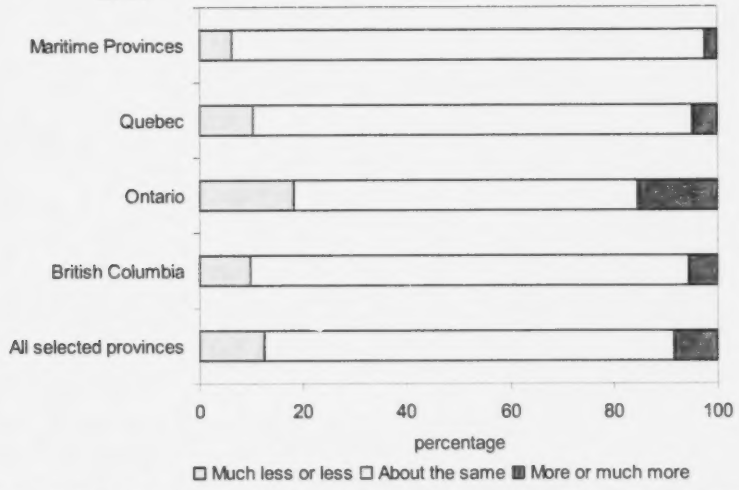
Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.6.3.1 Changes in weed incidences

Growers were asked if, in 2005, weeds were more, less or about equally prevalent compared to the last five years. Seventy-nine percent of the producing area was operated by growers who reported that the incidence of weeds was "about the same" in 2005 compared to the last five years (Figure 21).

"Much less or less" weed pressure was indicated for 12.5% of the producing area and the incidence of weeds was "more or much more" on 8.5% of the producing area. Ontario had the most growers reporting higher weed incidence than in the past (15.3% of the producing area).

Figure 21 Incidences of weeds compared to the last five years, selected provinces, apple producing area, 2005

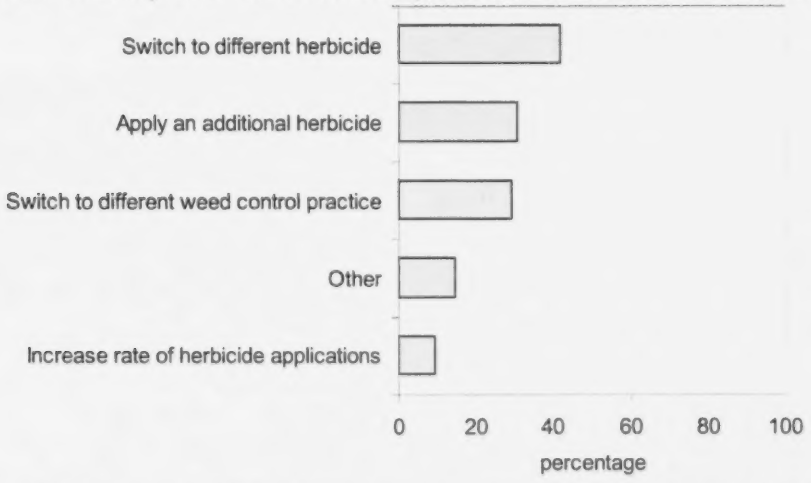


Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.6.3.2 Responses to higher weed pressure

Growers facing "more or much more" weed problems were asked what they planned to do to reduce weed problems during the next growing season. Less than 42% of the producing area with higher weed pressure was operated by growers who planned to switch to different herbicides in the future. About 29.3% of the producing area with higher weed pressure area was operated by growers who plan to switch to a different weed control practice (Figure 22).

Figure 22 Actions planned to reduce weed problems, selected provinces, apple producing area, 2005



Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
For farms that reported having "more" or "much more" weed problems compared to the last five years.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.7 Management practices and pest resistance to pesticides

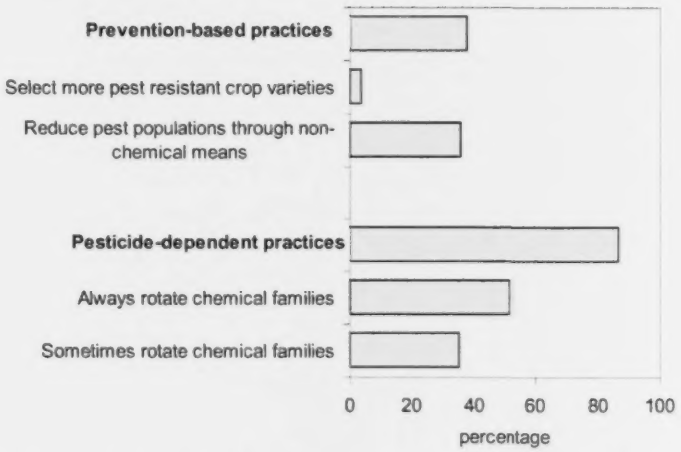
3.7.1 Practices used to manage resistance to pesticides

Growers were given a list of four practices that can help manage the emergence of populations of weeds, insects and diseases resistant to pesticides and were asked to identify which practices they commonly use that can help avoid the emergence of pest resistance. Two practices involve rotation between different pesticide classes (different modes of action) and two are basic preventive IPM practices (planting a resistant variety and reducing pest populations through non-chemical means).

Growers operating 86.7% of the apple producing area said that they either always rotated or sometimes rotated to pesticides in different chemical families (Figure 23).

Reducing pest populations through non-chemical means was used on 37.6% of the producing area, while selecting more pest resistant crop varieties was reported on less than 4% of the producing area.

Figure 23 Practices used to prevent pest resistance to chemical products, selected provinces, apple producing area, 2005



Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

3.7.2 Growers' perception of pests becoming resistant to pesticides

Respondents were asked if any weeds, insects or plant diseases on their entire operation had displayed signs of resistance to the pesticide applied to control them. Growers were then asked to what extent pests are becoming resistant to each group of pesticides. Figure 24 displays the reported degree of resistance for weeds, insects and plant diseases.

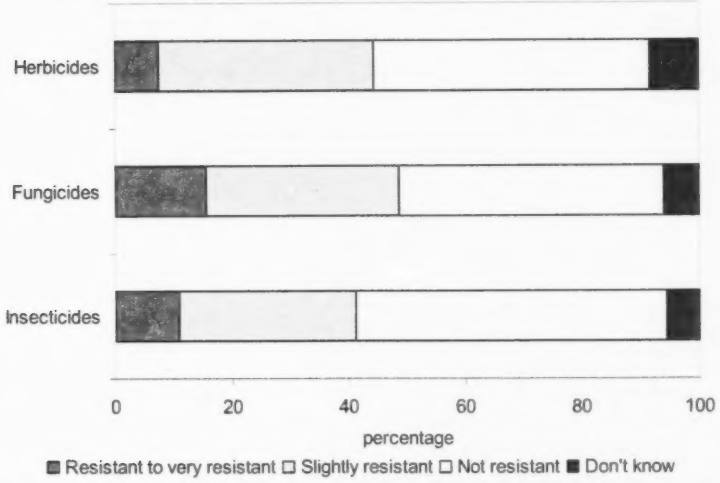
Growers reported that weeds are not resistant to herbicides on 47.1% of the apple producing area, while weeds are becoming slightly resistant on more than one-third (37.1%) of the apple producing area. About 7.4% of the producing area was plagued by weeds reported to be resistant or very resistant, while resistance status was unknown on 8.4% of the area.

The prevalence of resistance was similar among insects, where growers reported no signs of resistance in insects on 45.4% of the producing area and slight resistance on 33.0% of the producing area. Insects were regarded as resistant or very resistant on 15.7% of the area.

Disease pathogens were reported as not resistant on 53.1% of the producing area, slightly resistant on 30.4% and as resistant or highly resistant on 10.9% of the producing area.

Canadian apple producers face a significant challenge in managing resistance, given that resistant weeds, insects and plant diseases are already present on about one-third of the producing area.

Figure 24 Growers' perception that pests are becoming resistant to pesticides, selected provinces, apple producing area, 2005



Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

4 Conclusion

Canadian apple growers cope with threats to their crops from insects, diseases and weeds. To control these threats, growers use an integrated approach to control pests, which includes the use of pesticides and best management practices, allowing them to produce the quality crop consumers want to buy. Because apples are a perennial crop, with the same apple trees producing apples for many years, growers need to make decisions on what trees to plant in light of the long-term impact that variety selection has on both the production and marketing of fruit.

The use of pesticides is regulated in Canada through the Pest Control Products Act. Pesticides are evaluated for their safety in terms of the environment and human health. Pesticides used in Canada are considered to be safe if used according to the instructions provided on the label.

The data from this survey show that apple growers are using integrated pest management (IPM) practices to help control insects, diseases and weeds. Integrated pest management involves the use of a system of tools that work together to control pests. Tools include pesticides, but they also include a host of cultural practices and non-chemical tools that can help to control disease.

.

Appendix A – Statistical tables

Table A.1 Format used to keep records of pesticides applied, selected provinces, apple producing area, 2005

Format used for record-keeping system	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Written	1,831	3,758	4,999	2,399	12,986
Electronic	x	442	x	138	2,108
No record kept	x	497	x	666	1,422
Total producing area for reporting farms	2,439	4,697	6,179	3,196	16,510
	percentage				
Written	75.1	80.0	80.9	75.1	78.7
Electronic	x	9.4	x	4.3	12.8
No record kept	x	10.6	x	20.8	8.6

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.2 Information kept in record-keeping system, selected provinces, apple producing area, 2005

Information kept in record-keeping system	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Date of application	2,408	3,927	5,974	2,580	14,890
Identification of orchard	2,278	3,442	5,440	2,259	13,418
Total area treated	2,041	3,267	5,002	1,829	12,139
Product applied	2,408	4,132	5,989	2,647	15,176
Rate of application	2,272	3,986	5,840	2,386	14,484
Wind speed	379	1,091	1,636	396	3,502
Temperature at application	255	1,788	2,796	910	5,749
Targeted weed, insect or disease	1,733	1,510	3,330	1,864	8,438
Other information	646	719	1,244	416	3,026
Total producing area for reporting farms	2,439	4,697	6,179	3,196	16,510
	percentage				
Date of application	98.7	83.6	96.7	80.7	90.2
Identification of orchard	93.4	73.3	88.0	70.7	81.3
Total area treated	83.7	69.6	81.0	57.2	73.5
Product applied	98.7	88.0	96.9	82.8	91.9
Rate of application	93.2	84.9	94.5	74.7	87.7
Wind speed	15.5	23.2	26.5	12.4	21.2
Temperature at application	10.4	38.1	45.3	28.5	34.8
Targeted weed, insect or disease	71.1	32.2	53.9	58.3	51.1
Other information	26.5	15.3	20.1	13.0	18.3

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.3 Pesticide use in apple production, selected provinces, 2005

Pesticide types and active ingredients	Farms reporting	Treated area		Average application	Average rate of application	Quantity applied
	number	hectare	percentage[1]	number	kilograms per hectare	kilograms
Total herbicides, insecticides and fungicides	1,401	15,436	91.8	2.2	3.55	924,732
Herbicides	766	6,231	37.1	1.5	1.28	19,060
2,4-d	89	1,494	8.9	1.3	0.672	1,306
Clopyralid	x	x	x	x	x	x
Dichlobenil	x	x	x	x	x	x
Diquat	27	194	1.2	1.2	0.208	48.5
Fenoxaprop-p-ethyl	x	x	x	x	x	x
Glufosinate ammonium	55	491	2.9	1.2	0.499	302
Glyphosate	703	5,695	33.9	1.8	1.43	14,338
Linuron	x	x	x	x	x	x
Metribuzin	x	x	x	x	x	x
Paraquat	80	438	2.6	1.5	1.00	681
Pendimethalin	28	125	0.7	1.1	1.46	195
S-metolachlor and r-enantiomer	20	291	1.7	1.1	1.39	424
Simazine	86	667	4.0	1.0	2.03	1,410
Terbacil	13	108	0.6	1.0	1.67	181
Trifluralin	x	x	x	x	x	x
Insecticides	1,375	15,206	90.5	1.4	5.97	528,122
Abamectin	70	778	4.6	1.1	0.011	9.29
Acetamiprid	194	2,599	15.5	1.4	0.111	411
Azinphos-methyl	594	7,280	43.3	1.6	0.932	11,081
Bifenazate	20	231	1.4	1.2	0.304	84.8
Carbaryl	634	6,580	39.1	1.3	1.39	11,651
Clofentezine	x	x	x	x	x	x
Cyhalothrin-lambda	29	575	3.4	1.7	0.013	12.3
Cypermethrin	130	1,565	9.3	1.1	0.070	123
Deltamethrin	224	4,027	24.0	1.3	0.010	52.1
Diazinon	361	3,371	20.1	1.1	1.54	5,647
Dicofol	19	189	1.1	1.0	1.51	287
Dimethoate	37	466	2.8	1.2	0.937	532
Endosulfan	38	782	4.7	1.0	1.95	1,528
Formetanate hydrochloride	x	x	x	x	x	x
Imidacloprid	216	2,019	12.0	1.1	0.067	153
Malathion	17	119	0.7	1.1	0.838	108
Methomyl	23	307	1.8	1.5	1.00	450
Methoxyfenozide	63	1,018	6.1	1.4	0.232	333
Mineral oil	1,029	10,959	65.2	1.2	36.1	464,753
Permethrin	45	482	2.9	1.0	0.158	76.2
Phosalone	231	2,814	16.7	1.8	1.08	5,599
Phosmet	530	6,890	41.0	2.2	1.54	23,346
Pirimicarb	21	458	2.7	1.2	0.509	284
Pyridaben	91	1,092	6.5	1.1	0.203	239
Spinosad	339	4,371	26.0	1.4	0.085	510
Spirodiclofen	143	3,222	19.2	1.1	0.162	557
Tebufenozide	122	800	4.8	1.2	0.254	237

See notes at the end of the table.

Table A.3 Pesticide use in apple production, selected provinces, 2005 (concluded)

Pesticide types and active ingredients	Farms reporting	Treated area		Average application	Average rate of application	Quantity applied
	number	hectare	percentage[1]	number	kilograms per hectare	kilograms
Fungicides	1,303	14,563	86.6	3.5	2.41	377,550
Benomyl	x	x	x	x	x	x
Boscalid	x	x	x	x	x	x
Captan	712	10,520	62.6	4.7	2.25	111,396
Chlorothalonil	x	x	x	x	x	x
Copper oxychloride	39	520	3.1	1.3	1.52	990
Cyprodinil	6	107	0.6	1.3	0.212	29.8
Dinocap	18	163	1.0	1.2	0.275	52.3
Dodine	17	154	0.9	1.9	1.17	337
Flusilazole	161	3,157	18.8	1.9	0.030	185
Fosetyl-al	57	327	1.9	1.8	1.54	929
Kresoxim-methyl	166	2,307	13.7	1.7	0.124	495
Lime sulphur	34	255	1.5	1.7	1.31	564
Mancozeb	626	8,067	48.0	5.1	3.40	139,337
Metiram	614	6,882	40.9	4.6	3.48	110,015
Myclobutanil	654	6,296	37.5	2.0	0.134	1,686
Streptomycin	29	410	2.4	1.1	0.151	70.2
Sulphur	170	1,083	6.4	2.0	4.64	10,186
Thiophanate-methyl	23	187	1.1	1.3	0.543	137
Thiram	x	x	x	x	x	x
Tribasic copper sulphate	39	334	2.0	1.3	1.08	481
Trifloxystrobin	224	3,466	20.6	1.8	0.079	499
Ziram	x	x	x	x	x	x

Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
1. Percentage of total apple producing area.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.4 Pesticide use in apple production, Maritime Provinces, 2005

Pesticide types and active ingredients	Farms reporting	Treated area		Average application	Average rate of application	Quantity applied
	number	hectare	percentage[1]	number	kilograms per hectare	kilograms
Total herbicides, insecticides and fungicides	131	2,430	97.6	2.3	3.87	174,493
Herbicides	53	1,198	48.1	1.3	0.874	2,562
2,4-d	31	896	36.0	1.3	0.737	834
Diquat	x	x	x	x	x	x
Glufosinate ammonium	9	133	5.3	1.0	0.322	42.7
Glyphosate	45	1,054	42.3	1.5	1.02	1,566
Paraquat	x	x	x	x	x	x
Simazine	x	x	x	x	x	x
Terbacil	x	x	x	x	x	x
Insecticides	126	2,373	95.3	1.3	7.77	101,609
Acetamiprid	21	536	21.5	1.1	0.093	55.5
Azinphos-methyl	64	1,274	51.2	1.7	0.803	1,773
Bifenazate	x	x	x	x	x	x
Carbaryl	89	1,822	73.2	1.1	1.72	3,530
Clofentezine	x	x	x	x	x	x
Cyhalothrin-lambda	x	x	x	x	x	x
Cypermethrin	38	551	22.1	1.0	0.066	37.0
Deltamethrin	x	x	x	x	x	x
Dicofol	x	x	x	x	x	x
Dimethoate	19	272	10.9	1.1	0.835	259
Imidacloprid	24	643	25.8	1.2	0.074	57.5
Malathion	9	97	3.9	1.0	0.849	82.2
Methoxyfenozide	x	x	x	x	x	x
Mineral oil	79	1,727	69.4	1.1	50.4	92,629
Phosalone	23	417	16.7	2.2	0.892	801
Phosmet	35	553	22.2	1.9	1.57	1,688
Pirimicarb	20	452	18.2	1.2	0.510	282
Pyridaben	21	475	19.1	1.1	0.261	141
Spinosad	9	97	3.9	1.0	0.068	6.87
Spirodiclofen	30	605	24.3	1.1	0.181	123
Tebufenozide	x	x	x	x	x	x
Fungicides	126	2,381	95.6	4.1	2.42	70,322
Captan	116	2,296	92.2	6.8	2.38	37,102
Copper oxychloride	x	x	x	x	x	x
Cyprodinil	x	x	x	x	x	x
Dinocap	x	x	x	x	x	x
Dodine	x	x	x	x	x	x
Flusilazole	33	821	33.0	2.3	0.033	61.5
Fosetyl-al	x	x	x	x	x	x
Kresoxim-methyl	x	x	x	x	x	x
Lime sulphur	x	x	x	x	x	x
Mancozeb	28	553	22.2	3.8	3.81	8,080
Metiram	85	1,566	62.9	3.7	4.17	23,991
Myclobutanil	45	1,031	41.4	2.1	0.137	297
Sulphur	x	x	x	x	x	x
Trifloxystrobin	28	589	23.7	1.6	0.078	73.0

Note: 1. Percentage of total apple producing area.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.5 Pesticide use in apple production, Quebec, 2005

Pesticide types and active ingredients	Farms reporting	Treated area		Average application	Average rate of application	Quantity applied
	number	hectare	percentage[1]	number	kilograms per hectare	kilograms
Total herbicides, insecticides and fungicides	325	4,050	86.0	2.6	3.14	212,396
Herbicides	109	1,044	22.2	1.6	1.16	2,935
2,4-d	27	228	4.8	1.7	0.718	276
Clopyralid	x	x	x	x	x	x
Diquat	x	x	x	x	x	x
Glufosinate ammonium	18	91	1.9	1.1	0.593	57.5
Glyphosate	97	941	20.0	1.6	1.32	2,031
Paraquat	10	111	2.3	2.4	1.65	446
S-metolachlor and r-enantiomer	x	x	x	x	x	x
Simazine	24	110	2.3	1.0	0.942	104
Insecticides	314	3,925	83.3	1.3	5.82	105,163
Abamectin	43	419	8.9	1.2	0.009	4.78
Acetamiprid	24	259	5.5	1.8	0.055	24.9
Azinphos-methyl	196	2,372	50.4	1.4	0.97	3,114
Bifenazate	11	131	2.8	1.4	0.332	59.4
Carbaryl	59	680	14.4	1.4	0.928	864
Clofentezine	x	x	x	x	x	x
Cyhalothrin-lambda	14	195	4.2	1.6	0.011	3.34
Cypermethrin	61	625	13.3	1.3	0.062	50.8
Deltamethrin	60	919	19.5	1.1	0.010	9.19
Dicofol	x	x	x	x	x	x
Dimethoate	15	108	2.3	1.6	0.96	165
Endosulfan	11	171	3.6	1.0	2.58	442
Imidacloprid	x	x	x	x	x	x
Methomyl	x	x	x	x	x	x
Methoxyfenozide	x	x	x	x	x	x
Mineral oil	232	2,706	57.4	1.3	25.9	94,414
Permethrin	39	427	9.1	1.0	0.154	65.8
Phosalone	59	964	20.5	1.4	1.08	1,468
Phosmet	170	1,807	38.4	1.6	1.40	4,147
Pyridaben	32	243	5.2	1.0	0.175	44.0
Spinosad	65	969	20.6	1.2	0.079	92.5
Spirodiclofen	12	136	2.9	1.1	0.150	21.4
Tebufenozide	x	x	x	x	x	x
Fungicides	314	3,744	79.5	4.2	2.22	104,298
Benomyl	x	x	x	x	x	x
Captan	275	3,287	69.8	4.7	1.88	29,251
Copper oxychloride	14	181	3.8	1.3	1.40	324
Cyprodinil	x	x	x	x	x	x
Dodine	13	109	2.3	1.8	1.26	249
Flusilazole	57	548	11.6	1.6	0.026	22.8
Fosetyl-al	x	x	x	x	x	x
Kresoxim-methyl	48	602	12.8	1.4	0.130	107
Lime sulphur	x	x	x	x	x	x
Mancozeb	134	1,761	37.4	5.6	2.75	27,341
Metiram	211	2,455	52.1	6.2	3.00	45,920
Myclobutanil	87	929	19.7	2.0	0.119	218
Sulphur	x	x	x	x	x	x
Thiophanate-methyl	12	117	2.5	1.6	0.444	80.5
Thiram	x	x	x	x	x	x
Tribasic copper sulphate	17	117	2.5	1.0	1.63	190
Trifloxystrobin	59	952	20.2	1.8	0.075	128

Note: 1. Percentage of total apple producing area.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.6 Pesticide use in apple production, Ontario, 2005

Pesticide types and active ingredients	Farms reporting	Treated area		Average application	Average rate of application	Quantity applied
	number	hectare	percentage[1]	number	kilograms per hectare	kilograms
Total herbicides, insecticides and fungicides	380	6,077	98.2	2.3	2.96	350,386
Herbicides	155	1,901	30.7	1.2	1.31	5,257
2,4-d	19	308	5.0	1.0	0.520	160
Dichlobenil	x	x	x	x	x	x
Diquat	x	x	x	x	x	x
Glufosinate ammonium	22	260	4.2	1.4	0.526	191
Glyphosate	130	1,650	26.7	1.4	1.49	3,409
Linuron	x	x	x	x	x	x
Metribuzin	x	x	x	x	x	x
Paraquat	16	156	2.5	1.2	0.402	74.7
S-metolachlor and r-enantiomer	19	269	4.3	1.0	1.55	418
Simazine	29	382	6.2	1.0	1.99	761
Terbacil	x	x	x	x	x	x
Trifluralin	x	x	x	x	x	x
Insecticides	380	6,077	98.2	1.5	3.88	168,521
Abamectin	27	359	5.8	1.0	0.013	4.51
Acetamiprid	98	1,529	24.7	1.5	0.127	290
Azinphos-methyl	141	2,371	38.3	1.6	0.942	3,673
Bifenazate	x	x	x	x	x	x
Carbaryl	156	2,296	37.1	1.4	1.00	3,155
Clofentezine	x	x	x	x	x	x
Cyhalothrin-lambda	x	x	x	x	x	x
Cypermethrin	32	388	6.3	1.0	0.091	35.5
Deltamethrin	155	3,020	48.8	1.4	0.010	42.1
Diazinon	73	1,686	27.3	1.0	1.57	2,728
Dicofol	x	x	x	x	x	x
Dimethoate	x	x	x	x	x	x
Endosulfan	10	496	8.0	1.0	1.78	881
Formetanate hydrochloride	x	x	x	x	x	x
Imidacloprid	54	608	9.8	1.2	0.073	51.1
Methomyl	x	x	x	x	x	x
Methoxyfenozide	40	838	13.5	1.4	0.228	271
Mineral oil	256	4,190	67.7	1.2	27.6	136,652
Permethrin	x	x	x	x	x	x
Phosalone	59	940	15.2	2.1	1.11	2,166
Phosmet	298	4,376	70.7	2.5	1.58	17,086
Pyridaben	36	358	5.8	1.0	0.140	51.9
Spinosad	78	2,061	33.3	1.5	0.087	275
Spirodiclofen	98	2,466	39.9	1.1	0.157	408
Tebufenozide	13	186	3.0	1.1	0.299	60.7
Fungicides	364	5,851	94.6	3.6	2.49	176,608
Boscalid	x	x	x	x	x	x
Captan	280	4,719	76.3	3.8	2.46	44,082
Chlorothalonil	x	x	x	x	x	x
Copper oxychloride	12	267	4.3	1.2	1.64	542
Dinocap	13	131	2.1	1.1	0.289	41.9
Dodine	x	x	x	x	x	x
Flusilazole	38	1,413	22.8	2.0	0.031	88
Fosetyl-al	53	306	4.9	1.8	1.48	838
Kresoxim-methyl	75	1,383	22.4	2.0	0.120	334
Lime sulphur	x	x	x	x	x	x
Mancozeb	275	4,660	75.3	5.8	3.56	96,327
Metiram	151	1,822	29.4	4.6	3.64	30,756
Myclobutanil	146	2,637	42.6	2.3	0.137	821
Streptomycin	29	410	6.6	1.1	0.151	70.2
Sulphur	23	212	3.4	2.9	3.29	1,992
Thiophanate-methyl	x	x	x	x	x	x
Tribasic copper sulphate	22	212	3.4	1.5	0.825	257
Trifloxystrobin	62	1,467	23.7	2.2	0.081	257

Note: 1. Percentage of total apple producing area.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.7 Pesticide use in apple production, British Columbia, 2005

Pesticide types and active ingredients	Farms reporting	Treated area		Average application	Average rate of application	Quantity applied
	number	hectare	percentage[1]	number	kilograms per hectare	kilograms
Total herbicides, insecticides and fungicides	565	2,880	84.2	1.5	6.49	187,457
Herbicides	449	2,088	61.0	2.0	1.54	8,306
2,4-d	x	x	x	x	x	x
Diquat	10	49	1.4	1.1	0.249	13.7
Fenoxaprop-p-ethyl	x	x	x	x	x	x
Glufosinate ammonium	x	x	x	x	x	x
Glyphosate	431	2,049	59.9	2.3	1.57	7,331
Paraquat	52	143	4.2	1.4	0.775	150
Pendimethalin	28	125	3.7	1.1	1.46	195
Simazine	31	169	4.9	1.1	2.80	532
Terbacil	x	x	x	x	x	x
Insecticides	554	2,831	82.8	1.3	11.1	152,829
Acetamiprid	51	275	8.0	1.3	0.114	41.0
Azinphos-methyl	193	1,263	36.9	2.0	0.98	2,521
Carbaryl	329	1,782	52.1	1.3	1.81	4,102
Cyhalothrin-lambda	x	x	x	x	x	x
Diazinon	289	1,685	49.2	1.1	1.51	2,919
Dicofol	x	x	x	x	x	x
Dimethoate	x	x	x	x	x	x
Endosulfan	17	115	3.4	1.0	1.78	205
Imidacloprid	130	630	18.4	1.0	0.058	37.6
Malathion	x	x	x	x	x	x
Methoxyfenozide	19	64	1.9	1.3	0.327	28.2
Mineral oil	461	2,336	68.3	1.0	58.2	141,058
Phosalone	90	494	14.4	2.0	1.21	1,163
Phosmet	27	155	4.5	1.6	1.70	425
Pirimicarb	x	x	x	x	x	x
Pyridaben	x	x	x	x	x	x
Spinosad	188	1,243	36.3	1.3	0.086	136
Spirodiclofen	x	x	x	x	x	x
Tebufenozide	97	356	10.4	1.3	0.252	119
Fungicides	498	2,588	75.7	1.6	2.71	26,322
Benomyl	x	x	x	x	x	x
Captan	42	218	6.4	1.6	2.69	961
Copper oxychloride	x	x	x	x	x	x
Cyprodinil	x	x	x	x	x	x
Dinocap	x	x	x	x	x	x
Flusilazole	34	374	10.9	1.3	0.026	12.8
Kresoxim-methyl	35	230	6.7	1.2	0.149	40.6
Lime sulphur	20	56	1.6	1.1	4.14	265
Mancozeb	190	1,092	31.9	1.7	4.11	7,589
Metiram	167	1,039	30.4	2.0	4.51	9,347
Myclobutanil	376	1,699	49.7	1.5	0.139	351
Sulphur	144	813	23.8	1.7	5.43	7,452
Thiophanate-methyl	x	x	x	x	x	x
Tribasic copper sulphate	x	x	x	x	x	x
Trifloxystrobin	75	458	13.4	1.1	0.078	40.4
Ziram	x	x	x	x	x	x

Note: 1. Percentage of total apple producing area.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.8 Pesticide-use intensity in apple production, provinces and pesticide types, 2005

Provinces and pesticide types	Farms reporting	Quantity applied	Application rate		
			below	labelled	above
	number	kilograms		percentage[1]	
All selected provinces					
Total herbicides, insecticides and fungicides	1,401	924,732	31.4	57.0	11.6
Herbicides	766	19,060	37.1	56.3	6.7
Insecticides	1,375	528,122	33.6	59.2	7.2
Fungicides	1,303	377,550	29.6	55.8	14.6
Maritime Provinces					
Total herbicides, insecticides and fungicides	131	174,493	24.3	62.3	13.4
Herbicides	53	2,562	56.2	33.8	10.1
Insecticides	126	101,609	28.8	68.4	2.8
Fungicides	126	70,322	19.1	62.4	18.5
Quebec					
Total herbicides, insecticides and fungicides	325	212,396	40.8	52.4	6.8
Herbicides	109	2,935	48.9	40.2	10.9
Insecticides	314	105,163	43.2	50.2	6.7
Fungicides	314	104,298	39.5	53.9	6.6
Ontario					
Total herbicides, insecticides and fungicides	380	350,386	32.1	55.8	12.2
Herbicides	155	5,257	41.8	53.8	4.4
Insecticides	380	168,521	37.0	56.9	6.1
Fungicides	364	176,608	28.5	55.2	16.4
British Columbia					
Total herbicides, insecticides and fungicides	565	187,457	17.4	64.7	17.9
Herbicides	449	8,306	17.7	77.9	4.5
Insecticides	554	152,829	14.9	69.8	15.4
Fungicides	498	26,322	20.8	50.2	29.0

Note: 1. Percentage of cumulative treated area.
Source: Statistics Canada. 2005 Crop Protection Survey.

Table A.9 Pesticide-use intensity in apple production, selected provinces, 2005

Pesticide types and active ingredients	Farms reporting	Quantity applied	Application rate		
			below	labelled	above
	number	kilograms		percentage[1]	
Total herbicides, insecticides and fungicides	1,401	924,732	31.4	57.0	11.6
Herbicides	766	19,060	37.1	56.3	6.7
2,4-d	89	1,306	82.6	0.0	17.4
Clopyralid	x	x	100	0	0
Dichlobenil	x	x	100	0	0
Diquat	27	48.5	90.9	0.0	9.1
Fenoxaprop-p-ethyl	x	x	40.4	0.0	59.6
Glufosinate ammonium	55	302	42.8	54.8	2.4
Glyphosate	703	14,338	23.8	74.6	1.6
Linuron	x	x	100	0	0
Metribuzin	x	x	0	100	0
Paraquat	80	681	57.5	0.0	42.5
Pendimethalin	28	195	69.8	16.7	13.5
S-metolachlor and r-enantiomer	20	424	52.0	13.6	34.4
Simazine	86	1,410	46.0	50.6	3.4
Terbacil	13	181	0.0	89.6	10.4
Trifluralin	x	x	0	100	0
Insecticides	1,375	528,122	33.6	59.2	7.2
Abamectin	70	9.29	83.3	16.7	0.0
Acetamiprid	194	411	18.3	78.1	3.6
Azinphos-methyl	594	11,081	4.8	88.9	6.3
Bifenazate	20	84.8	100	0	0
Carbaryl	634	11,651	4.5	91.2	4.4
Clofentezine	x	x	20.5	76.4	3.1
Cyhalothrin-lambda	29	12.3	16.4	30.9	52.7
Cypermethrin	130	123	28.7	65.1	6.1
Deltamethrin	224	52.1	34.0	59.2	6.9
Diazinon	361	5,647	21.3	74.9	3.8
Dicofol	19	287	64.9	35.1	0.0
Dimethoate	37	532	26.5	73.5	0.0
Endosulfan	38	1,528	31.2	59.7	9.1
Formetanate hydrochloride	x	x	0	100	0
Imidacloprid	216	153	22.1	73.4	4.5
Malathion	17	108	27.5	72.5	0.0
Methomyl	23	450	8.3	91.7	0.0
Methoxyfenozide	63	333	12.1	82.3	5.6
Mineral oil	1,029	464,753	26.2	72.4	1.3
Permethrin	45	76.2	28.4	70.4	1.2
Phosalone	231	5,599	55.6	39.9	4.5
Phosmet	530	23,346	53.0	46.4	0.6
Pirimicarb	21	284	15.3	84.7	0.0
Pyridaben	91	239	80.9	19.1	0.0
Spinosad	339	510	57.9	0.0	42.1
Spirodiclofen	143	557	90.6	0.0	9.4
Tebufenozide	122	237	57.5	0.0	42.5

See notes at the end of the table.

Table A.9 Pesticide-use intensity in apple production, selected provinces, 2005 (concluded)

Pesticide types and active ingredients	Farms reporting	Quantity applied	Application rate below	Application rate labelled	Application rate above
	number	kilograms		percentage[1]	
Fungicides	1,303	377,550	29.6	55.8	14.6
Benomyl	x	x	0	0	100
Boscalid	x	x	100	0	0
Captan	712	111,396	17.1	58.9	24.0
Chlorothalonil	x	x	100	0	0
Copper oxychloride	39	990	96.6	0.0	3.4
Cyprodinil	6	29.8	6.0	86.8	7.2
Dinocap	18	52.3	100	0	0
Dodine	17	337	0	100	0
Flusilazole	161	185	44.1	44.7	11.2
Fosetyl-al	57	929	76.4	23.6	0.0
Kresoxim-methyl	166	495	15.0	80.0	5.0
Lime sulphur	34	564	91.6	3.8	4.6
Mancozeb	626	139,337	14.3	82.3	3.4
Metiram	614	110,015	46.9	46.3	6.8
Myclobutanil	654	1,686	55.1	0.0	44.9
Streptomycin	29	70.2	88.8	11.2	0.0
Sulphur	170	10,186	41.3	56.8	1.9
Thiophanate-methyl	23	137	67.7	28.7	3.6
Thiram	x	x	0	100	0
Tribasic copper sulphate	39	481	39.9	40.2	19.8
Trifloxystrobin	224	499	56.1	31.5	12.4
Ziram	x	x	100	0	0

Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
1. Percentage of cumulative treated area.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.10 Pesticide-use intensity in apple production, Maritime Provinces, 2005

Pesticide types and active ingredients	Farms reporting	Quantity applied	Application rate below	Application rate labelled	Application rate above
	number	kilograms		percentage[1]	
Total herbicides, insecticides and fungicides	131	174,493	24.3	62.3	13.4
Herbicides	53	2,562	56.2	33.8	10.1
2,4-d	31	834	73.9	0.0	26.1
Diquat	x	x	100	0	0
Glufosinate ammonium	9	42.7	94.3	5.7	0.0
Glyphosate	45	1,566	41.1	58.9	0.0
Paraquat	x	x	100	0	0
Simazine	x	x	0	100	0
Terbacil	x	x	0	100	0
Insecticides	126	101,609	28.8	68.4	2.8
Acetamiprid	21	55.5	12.6	87.4	0.0
Azinphos-methyl	64	1,773	7.2	90.5	2.3
Bifenazate	x	x	100	0	0
Carbaryl	89	3,530	2.1	95.8	2.1
Clofentezine	x	x	0	100	0
Cyhalothrin-lambda	6	2.66	0.0	51.8	48.2
Cypermethrin	38	37.0	32.9	67.1	0.0
Deltamethrin	x	x	91.4	8.6	0.0
Dicofol	x	x	100	0	0
Dimethoate	19	259	33.7	66.3	0.0
Imidacloprid	24	57.5	3.7	96.3	0.0
Malathion	9	82.2	36.7	63.3	0.0
Methoxyfenozide	x	x	0	100	0
Mineral oil	79	92,629	3.7	94.0	2.2
Phosalone	23	801	90.4	9.6	0.0
Phosmet	35	1,688	65.4	32.7	1.9
Pirimicarb	20	282	14.3	85.7	0.0
Pyridaben	21	141	73.0	27.0	0.0
Spinosad	9	6.87	100	0	0
Spirodiclofen	30	123	82.2	0.0	17.8
Tebufenozide	x	x	100	0	0
Fungicides	126	70,322	19.1	62.4	18.5
Captan	116	37,102	10.5	63.8	25.7
Copper oxychloride	x	x	100	0	0
Cyprodinil	x	x	0	100	0
Dinocap	x	x	100	0	0
Dodine	x	x	100	0	0
Flusilazole	33	61.5	22.6	77.4	0.0
Fosetyl-al	x	x	0.0	100.0	0.0
Kresoxim-methyl	x	x	17.5	82.5	0.0
Lime sulphur	x	x	100	0	0
Mancozeb	28	8,080	9.8	85.9	4.4
Metiram	85	23,991	19.0	77.7	3.3
Myclobutanil	45	297	51.2	0.0	48.8
Sulphur	x	x	100	0	0
Trifloxystrobin	28	73.0	69.2	26.5	4.4

Note: 1. Percentage of cumulative treated area.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.11 Pesticide-use intensity in apple production, Quebec, 2005

Pesticide types and active ingredients	Farms reporting	Quantity applied	Application rate below	Application rate labelled	Application rate above
	number	kilograms		percentage[1]	
Total herbicides, insecticides and fungicides	325	212,396	40.8	52.4	6.8
Herbicides	109	2,935	48.9	40.2	10.9
2,4-d	27	276	89.1	0.0	10.9
Clopyralid	x	x	100	0	0
Diquat	x	x	100	0	0
Glufosinate ammonium	18	57.5	38.9	49.7	11.4
Glyphosate	97	2,031	37.7	62.3	0.0
Paraquat	10	446	17.6	0.0	82.4
S-metolachlor and r-enantiomer	x	x	85.6	14.4	0.0
Simazine	24	104	100	0	0
Insecticides	314	105,163	43.2	50.2	6.7
Abamectin	43	4.78	86.2	13.8	0.0
Acetamiprid	24	24.9	78.7	21.3	0.0
Azinphos-methyl	196	3,114	8.5	81.5	10.0
Bifenazate	11	59.4	100	0	0
Carbaryl	59	864	5.6	83.0	11.4
Clofentezine	x	x	0.0	66.3	33.7
Cyhalothrin-lambda	14	3.34	38.8	61.2	0.0
Cypermethrin	61	50.8	39.6	47.2	13.3
Deltamethrin	60	9	40.4	50.1	9.5
Dicofol	x	x	0	100	0
Dimethoate	15	165	26.8	73.2	0.0
Endosulfan	11	442	56.6	1.7	41.6
Imidacloprid	x	x	100	0	0
Methomyl	x	x	29.5	70.5	0.0
Methoxyfenozide	x	x	0	100	0
Mineral oil	232	94,414	35.3	62.7	2.0
Permethrin	39	65.8	32.0	66.6	1.3
Phosalone	59	1,468	54.1	38.4	7.6
Phosmet	170	4,147	64.9	34.4	0.7
Pyridaben	32	44.0	79.7	20.3	0.0
Spinosad	65	92.5	75.6	0.0	24.4
Spirodiclofen	12	21.4	87.5	0.0	12.5
Tebufenozide	x	x	100	0	0
Fungicides	314	104,298	39.5	53.9	6.6
Benomyl	x	x	0	0	100
Captan	275	29,251	21.1	68.6	10.3
Copper oxychloride	14	324	97.2	0.0	2.8
Cyprodinil	x	x	0	100	0
Dodine	13	249	0	100	0
Flusilazole	57	22.8	41.0	59.0	0.0
Fosetyl-al	x	x	100	0	0
Kresoxim-methyl	48	107	12.7	81.0	6.3
Lime sulphur	x	x	100	0	0
Mancozeb	134	27,341	26.3	71.7	2.0
Metiram	211	45,920	63.2	32.8	4.0
Myclobutanil	87	218	72.9	0.0	27.1
Sulphur	x	x	0	100	0
Thiophanate-methyl	12	80.5	90.2	9.8	0.0
Thiram	x	x	0	100	0
Tribasic copper sulphate	17	190	11.6	49.7	38.7
Trifloxystrobin	59	128	43.3	51.9	4.8

Note: 1. Percentage of cumulative treated area.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.12 Pesticide-use intensity in apple production, Ontario, 2005

Pesticide types and active ingredients	Farms reporting	Quantity applied	Application rate below	Application rate labelled	Application rate above
	number	kilograms		percentage[1]	
Total herbicides, insecticides and fungicides	380	350,386	32.1	55.8	12.2
Herbicides	155	5,257	41.8	53.8	4.4
2,4-d	19	160	100	0	0
Dichlobenil	x	x	100	0	0
Diquat	x	x	100	0	0
Glufosinate ammonium	22	191	26.3	73.7	0.0
Glyphosate	130	3,409	28.5	70.0	1.6
Linuron	x	x	100	0	0
Metribuzin	x	x	0	100	0
Paraquat	16	74.7	86.4	0.0	13.6
S-metolachlor and r-enantiomer	19	418	45.4	15.5	39.1
Simazine	29	761	52.1	47.9	0.0
Terbacil	x	x	0	0	100
Trifluralin	x	x	0	100	0
Insecticides	380	168,521	37.0	56.9	6.1
Abamectin	27	4.51	79.2	20.8	0.0
Acetamiprid	98	290	7.8	86.7	5.5
Azinphos-methyl	141	3,673	2.9	91.4	5.7
Bifenazate	x	x	100	0	0
Carbaryl	156	3,155	5.5	91.7	2.7
Clofentezine	x	x	100	0	0
Cyhalothrin-lambda	x	x	8.1	0.0	91.9
Cypermethrin	32	35.5	0	100	0
Deltamethrin	155	42.1	31.0	62.6	6.4
Diazinon	73	2,728	5.4	88.4	6.2
Dicofol	x	x	88.1	11.9	0.0
Dimethoate	x	x	0	100	0
Endosulfan	10	881	24.9	75.1	0.0
Formetanate hydrochloride	x	x	0	100	0
Imidacloprid	54	51.1	30.2	64.4	5.4
Methomyl	x	x	0	100	0
Methoxyfenozide	40	271	14.7	81.5	3.8
Mineral oil	256	136,652	36.6	62.3	1.1
Permethrin	x	x	0	100	0
Phosalone	59	2,166	59.2	40.8	0.0
Phosmet	298	17,086	48.9	50.6	0.5
Pyridaben	36	51.9	92.5	7.5	0.0
Spinosad	78	275	67.9	0.0	32.1
Spirodiclofen	98	408	92.9	0.0	7.1
Tebufenozide	13	60.7	61.1	0.0	38.9
Fungicides	364	176,608	28.5	55.2	16.4
Boscalid	x	x	100	0	0
Captan	280	44,082	19.8	46.3	33.9
Chlorothalonil	x	x	100	0	0
Copper oxychloride	12	542	95.3	0.0	4.7
Dinocap	13	41.9	100	0	0
Dodine	x	x	0	100	0
Flusilazole	38	88.1	57.1	18.8	24.0
Fosetyl-al	53	838	81.0	19.0	0.0
Kresoxim-methyl	75	334	15.3	79.9	4.7
Lime sulphur	x	x	100	0	0
Mancozeb	275	96,327	10.9	85.3	3.8
Metiram	151	30,756	43.4	47.3	9.2
Myclobutanil	146	821	63.3	0.0	36.7
Streptomycin	29	70.2	88.8	11.2	0.0
Sulphur	23	1,992	79.2	15.7	5.1
Thiophanate-methyl	x	x	0	100	0
Tribasic copper sulphate	22	257	52.6	38.7	8.7
Trifloxystrobin	62	257	64.0	15.9	20.1

Note: 1. Percentage of cumulative treated area.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.13 Pesticide-use intensity in apple production, British Columbia, 2005

Pesticide types and active ingredients	Farms reporting	Quantity applied	Application rate below	Application rate labelled	Application rate above
	number	kilograms		percentage[1]	
Total herbicides, insecticides and fungicides	565	187,457	17.4	64.7	17.9
Herbicides	449	8,306	17.7	77.9	4.5
2,4-d	x	x	100	0	0
Diquat	10	13.7	61.3	0.0	38.7
Fenoxaprop-p-ethyl	x	x	40.4	0.0	59.6
Glufosinate ammonium	x	x	0.0	70.7	29.3
Glyphosate	431	7,331	11.2	86.1	2.7
Paraquat	52	150	79.5	0.0	20.5
Pendimethalin	28	195	69.8	16.7	13.5
Simazine	31	532	13.5	74.0	12.5
Terbacil	x	x	0	100	0
Insecticides	554	152,829	14.9	69.8	15.4
Acetamiprid	51	41.0	18.5	79.4	2.1
Azinphos-methyl	193	2,521	1.0	92.9	6.1
Carbaryl	329	4,102	4.6	89.5	5.8
Cyhalothrin-lambda	x	x	0	0	100
Diazinon	289	2,919	35.5	62.7	1.7
Dicofol	x	x	0	100	0
Dimethoate	x	x	0	100	0
Endosulfan	17	205	20.2	79.8	0.0
Imidacloprid	130	37.6	18.8	71.3	9.9
Malathion	x	x	0	100	0
Methoxyfenozide	19	28.2	0.0	58.9	41.1
Mineral oil	461	141,058	8.5	91.5	0.0
Phosalone	90	1,163	18.1	68.5	13.4
Phosmet	27	425	34.3	65.7	0.0
Pirimicarb	x	x	100	0	0
Pyridaben	x	x	100	0	0
Spinosad	188	136	22.3	0.0	77.7
Spirodiclofen	x	x	100	0	0
Tebufenozide	97	119	32.7	0.0	67.3
Fungicides	498	26,322	20.8	50.2	29.0
Benomyl	x	x	0	0	100
Captan	42	961	0.0	55.6	44.4
Copper oxychloride	x	x	100	0	0
Cyprodinil	x	x	39.6	12.8	47.6
Dinocap	x	x	100	0	0
Flusilazole	34	12.8	56.6	43.4	0.0
Kresoxim-methyl	35	40.6	18.3	76.2	5.5
Lime sulphur	20	265	43.8	25.3	30.9
Mancozeb	190	7,589	5.4	89.6	5.0
Metiram	167	9,347	17.3	54.8	28.0
Myclobutanil	376	351	26.3	0.0	73.7
Sulphur	144	7,452	20.6	78.7	0.7
Thiophanate-methyl	x	x	27.8	34.6	37.6
Tribasic copper sulphate	x	x	0	0	100
Trifloxystrobin	75	40.4	26.6	68.8	4.6
Ziram	x	x	100	0	0

Note: 1. Percentage of cumulative treated area.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.14 Spraying practices, selected provinces, apple producing area, 2005

Spraying practices	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Calibrate sprayer each year	2,206	4,033	5,470	2,298	14,008
Use highest labeled water volume	538	2,774	2,143	1,402	6,857
Replace nozzles every 3 years	1,297	2,720	4,044	2,252	10,314
Maintain sprayer travel speed less than 16 km/hr	2,345	4,242	5,918	3,168	15,673
Maintain low boom height	929	1,546	1,697	2,688	6,861
Adjust airblast direction	2,195	3,754	5,152	2,899	14,000
Spray only when wind speed low	2,150	4,111	5,322	3,179	14,761
Spray only when wind blows away from sensitive areas	2,128	2,178	5,435	2,636	12,378
Maintain lower pressure or use low-drift nozzles	1,195	1,881	2,730	1,806	7,612
Use protective shrouds or cones around sprayer boom	687	918	1,901	1,183	4,690
Other	362	121	341	309	1,133
Total producing area for reporting farms	2,489	4,711	6,187	3,421	16,808
	percentage				
Calibrate sprayer each year	88.6	85.6	88.4	67.2	83.3
Use highest labeled water volume	21.6	58.9	34.6	41.0	40.8
Replace nozzles every 3 years	52.1	57.8	65.4	65.8	61.4
Maintain sprayer travel speed less than 16 km/hr	94.2	90.0	95.6	92.6	93.2
Maintain low boom height	37.3	32.8	27.4	78.6	40.8
Adjust airblast direction	88.2	79.7	83.3	84.7	83.3
Spray only when wind speed low	86.4	87.3	86.0	92.9	87.8
Spray only when wind blows away from sensitive areas	85.5	46.2	87.8	77.1	73.6
Maintain lower pressure or use low-drift nozzles	48.0	39.9	44.1	52.8	45.3
Use protective shrouds or cones around sprayer boom	27.6	19.5	30.7	34.6	27.9
Other	14.6	2.6	5.5	9.0	6.7

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.15 Incidences of insects compared to the last five years, selected provinces, apple producing area, 2005

Incidence of insects	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Much less or less	634	1,546	1,475	1,300	4,954
About the same	1,524	2,786	3,532	1,563	9,405
More or much more	332	349	1,159	558	2,399
Total producing area for reporting farms	2,489	4,681	6,166	3,421	16,758
	percentage				
Much less or less	25.5	33.0	23.9	38.0	29.6
About the same	61.2	59.5	57.3	45.7	56.1
More or much more	13.3	7.5	18.8	16.3	14.3

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.16 Actions planned to reduce insect problems, selected provinces, apple producing area, 2005

Actions planned for the next growing season	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Prevention-based practices	282	316	1,145	455	2,199
Scout for insect or damage presence	282	266	1,145	380	2,073
Use forecasting systems	233	175	1,045	296	1,749
Take actions to disrupt insect reproduction or development	225	237	686	359	1,508
Pesticide-dependent practices	211	202	1,056	329	1,797
Switch to a different insecticide	182	189	795	235	1,401
Apply an additional insecticide	x	x	844	167	1,200
Increase rate of insecticide applications	83	0	10	42	136
Other	x	81	x	95	415
Total area for farms reporting increased insect problems	332	349	1,159	558	2,399
	percentage				
Prevention-based practices	84.8	90.6	98.8	81.6	91.7
Scout for insect or damage presence	84.8	76.2	98.8	68.1	86.4
Use forecasting systems	70.3	50.3	90.1	53.0	72.9
Take actions to disrupt insect reproduction or development	67.8	68.0	59.2	64.4	62.9
Pesticide-dependent practices	63.5	57.8	91.1	58.9	74.9
Switch to a different insecticide	54.8	54.3	68.6	42.1	58.4
Apply an additional insecticide	x	x	72.8	29.9	50.0
Increase rate of insecticide applications	25.0	0.0	0.9	7.6	5.7
Other	x	23.2	x	17.0	17.3

Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
For farms that reported having "more" or "much more" insect problems compared to the last five years.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.17 Growers reporting they had to deal with new insects, selected provinces, apple producing area, 2005

Dealing with new insects	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Yes	186	640	1,215	194	2,235
No	2,303	4,071	4,972	3,227	14,573
Total producing area for reporting farms	2,489	4,711	6,187	3,421	16,808
	percentage				
Yes	7.5	13.6	19.6	5.7	13.3
No	92.5	86.4	80.4	94.3	86.7

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.18 Most prevalent insect reported, selected provinces, apple producing area, 2005

Most prevalent insect	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Aphid	297	x	x	247	578
Apple sawfly	0	195	0	0	195
Apple maggot	412	424	x	x	1,114
Codling moth	732	589	1,407	934	3,662
Other moth	x	x	567	88	692
Leaf roller	x	x	459	877	1,832
Mites	361	321	318	0	1,000
Oblique banded leaf roller	x	822	1,817	x	2,723
Weevil	0	242	0	0	242
Other	365	549	550	96	1,559
Total producing area for reporting farms	2,402	3,648	5,409	2,288	13,747
	percentage				
Aphid	12.4	x	x	10.8	4.2
Apple sawfly	0.0	5.3	0.0	0.0	1.4
Apple maggot	17.1	11.6	x	x	8.1
Codling moth	30.5	16.2	26.0	40.8	26.6
Other moth	x	x	10.5	3.8	5.0
Leaf roller	x	x	8.5	38.3	13.3
Mites	15.0	8.8	5.9	0.0	7.3
Oblique banded leaf roller	x	22.5	33.6	x	19.8
Weevil	0.0	6.6	0.0	0.0	1.8
Other	15.2	15.0	10.2	4.2	11.3

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.19 Practices to control the most prevalent insect, selected provinces, apple producing area, 2005

Practices to control the most prevalent insect	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Pesticide-dependent practices	2,303	3,162	5,147	2,153	12,765
Apply insecticide throughout season	1,229	619	3,616	1,644	7,109
Time insecticide application at different development stages	2,283	3,020	4,678	1,741	11,723
Insecticide targeted at early nymph or egg stages	831	1,286	2,652	992	5,760
Insecticide targeted at larval or nymphal stages	778	1,272	1,933	1,210	5,193
Insecticide targeted at adult stage	1,397	773	805	326	3,302
Prevention-based practices	1,350	1,209	2,250	1,569	6,379
Take other steps to disrupt insect reproduction	397	607	818	1,076	2,898
Take other action to disrupt insect morphological development	238	325	309	490	1,361
Release beneficial organisms to control insect	305	143	39	440	927
Manage orchard to attract beneficial organisms	981	599	1,729	811	4,119
Total area for farms reporting a significant insect problem	2,402	3,648	5,409	2,288	13,747
	percentage				
Pesticide-dependent practices	95.9	86.7	95.2	94.1	92.9
Apply insecticide throughout season	51.2	17.0	66.9	71.9	51.7
Time insecticide application at different development stages	95.1	82.8	86.5	76.1	85.3
Insecticide targeted at early nymph or egg stages	34.6	35.3	49.0	43.3	41.9
Insecticide targeted at larval or nymphal stages	32.4	34.9	35.7	52.9	37.8
Insecticide targeted at adult stage	58.2	21.2	14.9	14.2	24.0
Prevention-based practices	56.2	33.1	41.6	68.6	46.4
Take other steps to disrupt insect reproduction	16.5	16.6	15.1	47.0	21.1
Take other action to disrupt insect morphological development	9.9	8.9	5.7	21.4	9.9
Release beneficial organisms to control insect	12.7	3.9	0.7	19.2	6.7
Manage orchard to attract beneficial organisms	40.8	16.4	32.0	35.4	30.0

Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
For farms that reported having a significant insect problem.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.20 Incidences of diseases compared to the last five years, selected provinces, apple producing area, 2005

Incidence of diseases	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Much less or less	354	1,212	2,660	1,114	5,340
About the same	1,509	2,557	2,437	1,878	8,381
More or much more	626	913	1,090	425	3,055
Total producing area for reporting farms	2,489	4,681	6,187	3,418	16,776
	percentage				
Much less or less	14.2	25.9	43.0	32.6	31.8
About the same	60.6	54.6	39.4	55.0	50.0
More or much more	25.2	19.5	17.6	12.4	18.2

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.21 Actions planned to reduce disease problems, selected provinces, apple producing area, 2005

Actions planned for the next growing season	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Prevention-based practices	563	497	957	350	2,368
Scout for disease damages	419	398	945	332	2,094
Use forecasting systems	451	290	913	277	1,932
Alter soil fertility or water management	201	71	86	50	409
Pesticide-dependent practices	495	428	877	310	2,110
Increase rate of fungicide applications	73	122	194	96	485
Switch to a different fungicide	334	225	736	189	1,484
Apply an additional fungicide	313	205	317	244	1,079
Other	150	300	459	122	1,031
Total area for farms reporting increased disease problems	626	913	1,090	425	3,055
	percentage				
Prevention-based practices	89.9	54.5	87.8	82.4	77.5
Scout for disease damages	66.9	43.6	86.7	78.0	68.5
Use forecasting systems	72.1	31.8	83.8	65.1	63.3
Alter soil fertility or water management	32.1	7.8	7.9	11.7	13.4
Pesticide-dependent practices	79.1	46.9	80.4	72.9	69.1
Increase rate of fungicide applications	11.6	13.4	17.8	22.5	15.9
Switch to a different fungicide	53.3	24.7	67.5	44.5	48.6
Apply an additional fungicide	49.9	22.5	29.0	57.3	35.3
Other	23.9	32.9	42.1	28.8	33.8

Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
For farms that reported having "more" or "much more" disease problems compared to the last five years.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.22 Growers reporting they had to deal with new diseases, selected provinces, apple producing area, 2005

Dealing with new diseases	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Yes	263	240	311	130	944
No	2,227	4,471	5,876	3,291	15,865
Total producing area for reporting farms	2,489	4,711	6,187	3,421	16,808
	percentage				
Yes	10.5	5.1	5.0	3.8	5.6
No	89.5	94.9	95.0	96.2	94.4

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.23 Most prevalent disease, selected provinces, apple producing area, 2005

Most prevalent disease	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Apple scab	1,914	2,740	4,642	272	9,568
Bacterial blight	378	254	470	59	1,160
Mildew	x	x	217	863	1,183
Other	x	546	x	116	786
Total producing area for reporting farms	2,437	3,540	5,410	1,310	12,697
	percentage				
Apple scab	78.5	77.4	85.8	20.8	75.4
Bacterial blight	15.5	7.2	8.7	4.5	9.1
Mildew	x	x	4.0	65.9	9.3
Other	x	15.4	x	8.9	6.2

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.24 Tools to make decisions on when to apply fungicides, selected provinces, apple producing area, 2005

Decision tools or methods used	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Calendar spraying	929	1,161	1,413	599	4,102
Scouting reports and thresholds	836	2,334	4,260	821	8,251
Regional forecasting / warning services	1,725	2,735	4,485	635	9,579
Climatic conditions	1,819	3,272	4,750	937	10,777
Advice from other operators	543	568	1,838	483	3,432
Advice from a chemical sales salesperson	865	1,175	1,991	136	4,167
Other	260	x	x	228	879
Total area for farms reporting a significant disease problem	2,397	3,494	5,299	1,310	12,500
	percentage				
Calendar spraying	38.8	33.2	26.7	45.8	32.8
Scouting reports and thresholds	34.9	66.8	80.4	62.7	66.0
Regional forecasting / warning services	71.9	78.3	84.6	48.5	76.6
Climatic conditions	75.9	93.6	89.6	71.5	86.2
Advice from other operators	22.7	16.3	34.7	36.8	27.5
Advice from a chemical sales salesperson	36.1	33.6	37.6	10.4	33.3
Other	10.8	x	x	17.4	7.0

Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
For farms that reported having a significant disease problem.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.25 Practices to control the most prevalent disease, selected provinces, apple producing area, 2005

Practices to control the most prevalent disease	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Plant certified disease free transplants	159	630	446	235	1,469
Select plant variety resistant to the major disease threats	262	462	468	164	1,355
Eliminate possible sources of inoculum	2,057	1,156	2,697	847	6,757
Clean equipment to reduce risk of transporting disease spores	651	1,662	1,860	452	4,624
Adjust fertilizer levels to prevent excessive levels of nutrients	1,705	1,754	3,184	766	7,410
Test your soil for micronutrient imbalances	1,268	1,960	2,188	370	5,786
Alter the timing of fertilization and/or water applications	684	926	1,352	564	3,527
Total area for farms reporting a significant disease problem	2,437	3,540	5,410	1,310	12,697
	percentage				
Plant certified disease free transplants	6.5	17.8	8.2	17.9	11.6
Select plant variety resistant to the major disease threats	10.8	13.0	8.6	12.5	10.7
Eliminate possible sources of inoculum	84.4	32.7	49.9	64.6	53.2
Clean equipment to reduce risk of transporting disease spores	26.7	46.9	34.4	34.5	36.4
Adjust fertilizer levels to prevent excessive levels of nutrients	70.0	49.5	58.9	58.5	58.4
Test your soil for micronutrient imbalances	52.0	55.4	40.4	28.3	45.6
Alter the timing of fertilization and/or water applications	28.1	26.2	25.0	43.1	27.8

Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
For farms that reported having a significant disease problem.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.26 Practices for weed management, selected provinces, apple producing area, 2005

Weed management practices	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Use mulch	975	645	1,621	1,319	4,561
Plant a cover crop	233	278	1,665	532	2,707
Use a cultivator or rotary hoe	127	738	275	659	1,800
Other method	772	1,114	893	635	3,415
Hand weeding	41	x	x	75	128
Mowing	772	939	797	478	2,986
Total producing area for reporting farms	2,489	4,711	6,187	3,421	16,808
	percentage				
Use mulch	39.2	13.7	26.2	38.6	27.1
Plant a cover crop	9.4	5.9	26.9	15.5	16.1
Use a cultivator or rotary hoe	5.1	15.7	4.5	19.3	10.7
Other method	31.0	23.7	14.4	18.6	20.3
Hand weeding	1.7	x	x	2.2	0.8
Mowing	31.0	19.9	12.9	14.0	17.8

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.27 Incidences of weeds compared to the last five years, selected provinces, apple producing area, 2005

Incidence of weeds	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Much less or less	153	481	1,132	332	2,098
About the same	2,265	3,976	4,110	2,871	13,222
More or much more	59	224	945	190	1,419
Total producing area for reporting farms	2,477	4,681	6,187	3,393	16,739
	percentage				
Much less or less	6.2	10.3	18.3	9.8	12.5
About the same	91.4	84.9	66.4	84.6	79.0
More or much more	2.4	4.8	15.3	5.6	8.5

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.28 Actions planned to reduce weed problems, selected provinces, apple producing area, 2005

Actions planned for the next growthing season	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Switch to different herbicide	x	x	499	60	595
Apply an additional herbicide	x	98	264	x	438
Increase rate of herbicide applications	x	x	24	x	133
Switch to different weed control practice	x	x	352	54	416
Other	39	x	93	x	210
Total area for farms reporting increased weed problems	59	224	945	190	1,419
	percentage				
Switch to different herbicide	x	x	52.7	31.4	41.9
Apply an additional herbicide	x	43.7	27.9	x	30.9
Increase rate of herbicide applications	x	x	2.6	x	9.3
Switch to different weed control practice	x	x	37.2	28.7	29.3
Other	65.8	x	9.8	x	14.8

Notes: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
For farms that reported having "more" or "much more" weed problems compared to the last five years.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.29 Practices used to prevent weeds, insects and disease resistance to chemical products, selected provinces, apple producing area, 2005

Practices used to prevent resistance to chemical products	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Pesticide-dependent practices	2,148	3,848	5,776	2,808	14,581
Always rotate chemical families	1,206	2,206	3,820	1,403	8,634
Sometimes rotate chemical families	942	1,642	1,957	1,405	5,946
Prevention-based practices	1,526	1,330	1,822	1,650	6,328
Select more pest resistant crop varieties	60	240	91	187	579
Reduce pest populations through non-chemical means	1,506	1,183	1,765	1,530	5,984
Other	350	874	681	680	2,584
Total producing area for reporting farms	2,489	4,711	6,187	3,421	16,808
	percentage				
Pesticide-dependent practices	86.3	81.7	93.4	82.1	86.7
Always rotate chemical families	48.4	46.8	61.7	41.0	51.4
Sometimes rotate chemical families	37.9	34.9	31.6	41.1	35.4
Prevention-based practices	61.3	28.2	29.4	48.2	37.6
Select more pest resistant crop varieties	2.4	5.1	1.5	5.5	3.4
Reduce pest populations through non-chemical means	60.5	25.1	28.5	44.7	35.6
Other	14.1	18.5	11.0	19.9	15.4

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.30 Growers' perception that weeds are becoming resistant to herbicides, selected provinces, apple producing area, 2005

Resistance to herbicides perception	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Resistant to very resistant	40	440	618	108	1,206
Slightly resistant	769	1,252	2,681	1,298	6,000
Not resistant	1,368	2,060	2,561	1,625	7,614
Don't know	251	749	180	182	1,362
Total producing area for reporting farms	2,428	4,500	6,040	3,214	16,182
	percentage				
Resistant to very resistant	1.6	9.8	10.2	3.4	7.4
Slightly resistant	31.7	27.8	44.4	40.4	37.1
Not resistant	56.3	45.8	42.4	50.6	47.1
Don't know	10.3	16.6	3.0	5.7	8.4

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.31 Growers' perception that insects are becoming resistant to insecticides, selected provinces, apple producing area, 2005

Resistance to insecticides perception	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Resistant to very resistant	37	1,099	1,185	260	2,580
Slightly resistant	859	1,237	2,150	1,184	5,429
Not resistant	1,415	1,936	2,524	1,587	7,462
Don't know	179	370	220	198	967
Total producing area for reporting farms	2,489	4,642	6,078	3,229	16,438
	percentage				
Resistant to very resistant	1.5	23.7	19.5	8.0	15.7
Slightly resistant	34.5	26.7	35.4	36.7	33.0
Not resistant	56.8	41.7	41.5	49.2	45.4
Don't know	7.2	8.0	3.6	6.1	5.9

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

Table A.32 Growers' perception that diseases are becoming resistant to fungicides, selected provinces, apple producing area, 2005

Resistance to fungicides perception	Producing area				
	Maritime Provinces	Quebec	Ontario	British Columbia	All selected provinces
	hectares				
Resistant to very resistant	53	781	847	122	1,804
Slightly resistant	583	1,448	1,993	1,019	5,042
Not resistant	1,752	2,192	2,968	1,885	8,797
Don't know	101	253	380	202	935
Total producing area for reporting farms	2,489	4,673	6,187	3,227	16,577
	percentage				
Resistant to very resistant	2.1	16.7	13.7	3.8	10.9
Slightly resistant	23.4	31.0	32.2	31.6	30.4
Not resistant	70.4	46.9	48.0	58.4	53.1
Don't know	4.1	5.4	6.1	6.2	5.6

Note: Includes Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia.
Source: Statistics Canada, 2005 Crop Protection Survey.

2005 Crop Protection Survey

Apple Growers

CONFIDENTIAL when completed

Collected under the authority of the Statistics Act, Revised Statutes of Canada, 1985, Chapter S-19.

To correct or make changes to this label → GO to Step 1.

Ce questionnaire est disponible en français.

For interviewer use only

Fully completed	005	1	
Partial	005	4	
Refusal	005	2	
No contact	005	3	
In operation	004	00	
Change of operator	004	12	
Out of business	004	13	

TO THE RESPONDENT:

The objective of this survey is to collect more accurate pesticide use and pest management data from Canadian farmers to help researchers, government agencies and farm organizations document and track changes in pesticide use and pest management systems.

Your responses will help ensure that there are accurate and sound data available on the crops you produce.

Every questionnaire counts, SO please respond.

This is a voluntary survey conducted under Section 8 of the Statistics Act. Your cooperation is important to ensure that the information collected in this survey is accurate.

All information will be kept confidential under the Statistics Act.

Please refer to the 2005 calendar year when answering the questions.

In order to avoid duplication, Statistics Canada will add the responses you provide in this survey to the information you supplied for the 2005 Fruit and Vegetables Survey. The combined information will be used strictly for statistical purposes and published in aggregate form only.

STEP 1: Change or correction to the address label (if required)

1 Are there any changes required to the address label?

11 Corporation name

12 Operator name

13 Contact name

14 Area code

15 Telephone contact person

16 Telephone operator

17 R.R.

18 Box No.

19 Number and street name

20 Postal code

21 Post office (name of city, town or village where mail is received)

5-5100-492 1 STC/AGR-450-75402

Statistics Canada / Statistique Canada

Canada

STEP 2: Questions about the orchards where APPLES were grown for sale in 2005.

2 What UNIT OF MEASURE will be used to report land areas? [22] This same unit should be used throughout the questionnaire.

(Check one circle only.) ○ [01] Acres ○ [02] Hectares ○ [03] Arpents (Quebec only)

3 What was your total producing and non-producing apple area *(all varieties)* on this operation in 2005? ..... [60]

4 What was your total producing apple area *(all varieties)*? ..... [23]

5 How many orchards *(varieties of apple, cultivars or plots)* produced apples for sale? ..... [24]

Include:
- ► all areas of apples grown for sale to the fresh or processing markets in 2005;
- ► all areas of apples grown for sale at roadside stands, farmer's markets or U-pick systems.

Do not include:
- ► apples grown for home use.

To save time, this interview will focus on one producing orchard only. First, we will list all producing orchards *(varieties of apple, cultivars or plots)* **in production in 2005. You can use your identification system (name, number or description) to report each orchard. Then, I will select one producing orchard** *(variety of apple, cultivar or plot)* **from the list.**

6 What were your producing orchards in 2005?

- ► *If the respondent uses a different term than "orchard" (variety of apple, cultivar or plot) to describe the apple producing area, please specify here:* _____ [25]
- ► *If there are more than 10 producing orchards, list the 10 largest producing orchards.*

Name, number or orchard description		Name, number or orchard description	
1		6	
2		7	
3		8	
4		9	
5		10	

Now, I will select one producing orchard from all producing orchards in 2005.

Interviewer action: enter the selected orchard (variety of apple, cultivar or plot) number ..... [26]

The selected producing orchard is: _____ During this interview, I will ask you questions about this orchard.

7 What was the area of this selected orchard *(variety of apple, cultivar or plot)*? ..... [27]

8 How many bearing trees were in this selected orchard? ..... [61]

9 What year was the selected orchard planted? ..... [62]

10 In 2005, ... *if more than one, report the most important*

a) which apple variety (or cultivar) was grown? ..... [29] _____

b) when did harvest start? ..... [32] [35] [38] [41]

c) when did harvest finish? ..... [33] [36] [39] [42]

STEP 3: Questions about herbicide, insecticide or fungicide applications from January 1 to December 31, 2005 on the orchard selected in Step 2.

11 In 2005, did you apply any herbicides, insecticides, fungicides or other pesticides on the selected orchard? [43]

[01] ○ Yes [02] ○ No *If "YES", continue to question 12. If "NO" → Go to Step 4.*

12 What format was used to keep records of herbicides, insecticides, fungicides or other pesticides applied to this orchard? [44]

Was it ...? *(Check all that apply.)*

[01] ○ Written [02] ○ Electronic/computer file [03] ○ No record kept

13 What information is kept in your logs/record-keeping system?

Does it include the ...? *(Check all that apply.)*

[45] ○ Date of application
[46] ○ Identification of orchard
[47] ○ Total area treated
[48] ○ Product applied
[49] ○ Rate of application
[50] ○ Wind speed
[51] ○ Temperature at application
[52] ○ Targeted weed, insect or disease
[53] ○ Other, specify: _____ [54]

14 Did the company or person purchasing your produce require the use of specific herbicides, insecticides or fungicides as part of a contractual agreement? [55]

[01] ○ Yes [02] ○ No [03] ○ Not applicable, the produce was not sold to a processor under a contractual agreement.

5-5100-492 1

STEP 3: Questions about herbicide, insecticide or fungicide applications from January 1 to December 31, 2005 on the orchard selected in Step 2

15 What chemicals were applied to the selected orchard in 2005? Report ALL CHEMICAL APPLICATIONS to the SELECTED ORCHARD in this table.

Include all applications to the SELECTED ORCHARD (Step 2) made by the respondent, a partner, an employee or a custom applicator.

- *Where necessary (more than 45 applications or lines), use additional tables supplied with the interviewer material*
- *For pre-packaged mixes, enter the product code found in the Interviewer Reference Guide*
- *If the respondent mixed more than one product in the tank, use a different line for each product mixed*
- *If the code of a pre-packaged mix is not included in the list, report its name at the bottom of this table (p. 4)*

Check if you use additional table ☐ 099

Line	Column [1] Date of application	Column [2] Which product was applied? (Enter product name or code from the Interviewer Reference Guide)	Column [3] What was the rate of application? (e.g. 1 litre per acre)	Column [4] What was the application technique? (Enter the application technique code p. 4)	Column [5] If this application was a local or half row treatment, what percent of the ORCHARD was treated?
1	101	201	301 per 401	501	601
2	102	202	302 per 402	502	602
3	103	203	303 per 403	503	603
4	104	204	304 per 404	504	604
5	105	205	305 per 405	505	605
6	106	206	306 per 406	506	606
7	107	207	307 per 407	507	607
8	108	208	308 per 408	508	608
9	109	209	309 per 409	509	609
10	110	210	310 per 410	510	610
11	111	211	311 per 411	511	611
12	112	212	312 per 412	512	612
13	113	213	313 per 413	513	613
14	114	214	314 per 414	514	614
15	115	215	315 per 415	515	615
16	116	216	316 per 416	516	616
17	117	217	317 per 417	517	617
18	118	218	318 per 418	518	618
19	119	219	319 per 419	519	619
20	120	220	320 per 420	520	620
21	121	221	321 per 421	521	621
22	122	222	322 per 422	522	622
23	123	223	323 per 423	523	623
24	124	224	324 per 424	524	624

Line	Column [1] Date of application	Column [2] Which product was applied? (Enter product name or code from the Interviewer Reference Guide)	Column [3] What was the rate of application? (e.g. 1 litre per acre)	Column [4] What was the application technique? (Enter the application technique code p. 4)	Column [5] If this application was a local or half row treatment, what percent of the ORCHARD was treated?
25	125	225	325 per 425	525	625
26	126	226	326 per 426	526	626
27	127	227	327 per 427	527	627
28	128	228	328 per 428	528	628
29	129	229	329 per 429	529	629
30	130	230	330 per 430	530	630
31	131	231	331 per 431	531	631
32	132	232	332 per 432	532	632
33	133	233	333 per 433	533	633
34	134	234	334 per 434	534	634
35	135	235	335 per 435	535	635
36	136	236	336 per 436	536	636
37	137	237	337 per 437	537	637
38	138	238	338 per 438	538	638
39	139	239	339 per 439	539	639
40	140	240	340 per 440	540	640
41	141	241	341 per 441	541	641
42	142	242	342 per 442	542	642
43	143	243	343 per 443	543	643
44	144	244	344 per 444	544	644
45	145	245	345 per 445	545	645

For chemicals not listed in the Interviewer Reference Guide, please specify below:

Line	Name of formulated product or PCP number	Form of product purchased (e.g. powders, emulsifiable concentrates, granules)
	701	708
	702	709
	703	710
	704	711
	705	712
	706	713
	707	714

Application technique codes

(Enter codes in Column 4 above)

1= Broadcast spraying (boom or non-boom)
2= Band spraying
3= Orchard airblast - axial fan
4= Orchard airblast - cross-flow tower
5= Spraying by airplane
6= Spraying by helicopter
7= Chemigation - low-pressure drop tube
8= Chemigation - high pressure gun
9= Backpack spraying
10= Granular application
11= Pheromones & pit trap
12= Other (specify on the line in Column 2)

5-5100-492.1

STEP 4: Questions about WEED, INSECT, DISEASE AND OTHER PEST MANAGEMENT PRACTICES in 2005 for the orchard selected in Step 2

16 Which practices do you use in your spray operation in this orchard in 2005?

Do you ...? *(Check all that apply.)*

816 ○ Calibrate sprayer each year
817 ○ Use the highest labelled water volume
818 ○ Replace nozzles at least every three years
819 ○ Maintain sprayer travel speed less than 16 km/h
820 ○ Maintain low boom height
821 ○ Adjust airblast direction for target height
822 ○ Spray only when wind speeds are low (less than five km/h)
823 ○ Spray only when wind blows away from sensitive areas
824 ○ Maintain lower pressure or use low-drift nozzle
825 ○ Use protective shrouds or cones around sprayer boom
826 ○ Other, specify: 827 _____ 828 _____

17 In 2005, for the selected orchard, was the incidence of INSECTS compared to the last five years ...? 844

(Check one circle only.)

01 ○ Much less 02 ○ Less 03 ○ About the same
04 ○ More 05 ○ Much more

If the answer is "More" or "Much more", continue to question 18. Otherwise → Go to Question 19.

18 What do you plan to do during the next growing season to reduce your INSECT problems?

Will you ...? *(Check all that apply)*

951 ○ Scout for insect or damage presence
952 ○ Use forecasting systems
847 ○ Switch to a different insecticide
848 ○ Apply an additional insecticide
849 ○ Take actions to disrupt insect reproduction or development
850 ○ Increase rate of insecticide applications
851 ○ Other, specify: 852 _____ 853 _____

19 In 2005, did you deal with any NEW INSECTS in this field? 854

02 ○ No 01 ○ Yes

► **If yes, what was the main insect?** _____

20 In 2005, for the selected orchard, what was the MOST PREVALENT INSECT you had to control?

If there was no significant insect problem, enter "0" and skip to Question 22. 856 _____

21 What did you do to control the MOST PREVALENT INSECT?

Did you ...? *(Check all that apply.)*

857 ○ Apply insecticides throughout the growing season
858 ○ Time insecticide applications to target the insect at different development stages
What were the developmental stages? *If not applicable, go to next choice: Between*
859 ○ Early nymph or egg stages
860 ○ Larval or nymphal stages
861 ○ Adult
862 ○ Take other steps to disrupt the reproduction of this insect
863 ○ Take other actions to disrupt the seasonal biological development of this insect
865 ○ Release beneficial organisms to control this insect
866 ○ Manage this orchard and its surrounding area to attract beneficial organisms

22 In 2005, for the selected orchard, was the incidence of DISEASES (fungus, bacteria, mildew) compared to the last five years ...? 867

(Check one circle only.)

01 ○ Much less 02 ○ Less 03 ○ About the same
04 ○ More 05 ○ Much more

If the answer is "More" or "Much more", continue to question 23. Otherwise → Go to Question 24.

23 What do you plan to do during the next growing season to reduce your DISEASE problems?

Will you...? *(Check all that apply)*

953 ○ Scout for disease damages
869 ○ Increase rate of fungicide applications
870 ○ Switch to a different fungicide
871 ○ Apply an additional fungicide
954 ○ Use forecasting systems
873 ○ Alter soil fertility or water management
874 ○ Other, specify: 875 _____ 876 _____

24 In 2005, did you deal with any NEW DISEASES in this orchard? 877

02 ○ No 01 ○ Yes

► **If yes, what was the main disease?** 878 _____

25 For the selected orchard, what was the MOST PREVALENT DISEASE (fungus, bacteria, mildew) you had to control?

If there was no significant insect problem, enter "0" and skip to Question 28. 879 _____

26 What tools/methods did you or your advisor use to make decisions on when to apply fungicides in this orchard to control the MOST PREVALENT DISEASE?

Was the decision based on ...? *(Check all that apply.)*

880 ○ A set application schedule (calendar spraying)
881 ○ Scouting reports and thresholds
882 ○ Regional forecasting/warning services
883 ○ Climatic conditions (degree days, moisture)
884 ○ Advice from other operators
885 ○ Advice from a chemical salesperson
886 ○ Don't know
887 ○ Other, specify: 888 _____

STEP 4: Questions about WEED, INSECT, DISEASE AND OTHER PEST MANAGEMENT PRACTICES in 2005 for the orchard selected in Step 2.

27 In 2005, which practices did you use to avoid the MOST PREVALENT DISEASE (fungus, bacteria, mildew) in this orchard?

Did you ...?

(Check all that apply.)

889 ○ **Plant certified disease-free transplants**
890 ○ **Select the plant variety known to be most resistant to the major disease threats in your area**
891 ○ **Eliminate possible sources of inoculum, such as cull piles, pruning residue or volunteer plants in nearby fields**
892 ○ **Clean equipment moving into this orchard to reduce risk of transporting disease spores or inoculum**
893 ○ **Adjust fertilizer levels to prevent excessive levels of nutrients in the root zone and foliage**
894 ○ **Test your soil for micronutrient imbalances that can promote certain diseases**
895 ○ **Alter the timing of fertilization and/or water applications**

28 In 2005, did you use any of the following practices in this orchard for WEED management?

Did you ...?

(Check all that apply.)

829 ○ **Mulch**
830 ○ **Plant a cover crop**
831 ○ **Use a cultivator or rotary hoe**
832 ○ **Chop or remove pruning residue**
833 ○ **Other, specify:** _____ 834

29 In 2005, for the selected orchard, was the incidence of WEEDS compared to the last five years ...? 835

(Check one circle only.)

01 ○ **Much less** 02 ○ **Less** 03 ○ **About the same**
04 ○ **More** 05 ○ **Much more**

If "More" or "Much more", continue to question 30. Otherwise → Go to Question 31.

30 What do you plan to do during the next growing season to reduce your WEED problems?

Will you ...? *(Check all that apply.)*

836 ○ **Switch to a different herbicide**
837 ○ **Apply an additional herbicide**
838 ○ **Increase rate of herbicide applications**
955 ○ **Switch to a different weed control practice**
841 ○ **Other, specify:** _____ 842
_____ 843

STEP 5: Questions about weed, insect and disease RESISTANCE to chemical applications for your ENTIRE OPERATION

31 In 2005, did you use any of the following practices to prevent weeds, insects and disease resistance to chemical products?

Did you ...? *(Check all that apply.)*

896 ○ **Always rotate chemical families (or groups)**
898 ○ **Sometimes rotate chemical families (or groups)**
897 ○ **Select more pest resistant crop varieties**
899 ○ **Reduce pest populations through non-chemical means**
900 ○ **Other, specify:** _____ 901

32 On YOUR FARM, to what extent, if any, are weeds becoming resistant to HERBICIDES?

Are weeds becoming ...? *(Check one circle only.)*

01 ○ **Very resistant** 02 ○ **Resistant** 03 ○ **Slightly resistant** 04 ○ **Not resistant** 09 ○ **Don't know** 902

33 On YOUR FARM, to what extent, if any, are insects becoming resistant to INSECTICIDES?

Are insects becoming ...? *(Check one circle only.)*

01 ○ **Very resistant** 02 ○ **Resistant** 03 ○ **Slightly resistant** 04 ○ **Not resistant** 09 ○ **Don't know** 903

34 On YOUR FARM, to what extent, if any, are diseases becoming resistant to FUNGICIDES?

Are diseases becoming ...? *(Check one circle only.)*

01 ○ **Very resistant** 02 ○ **Resistant** 03 ○ **Slightly resistant** 04 ○ **Not resistant** 09 ○ **Don't know** 904

STEP 6: Questions are about the herbicide, insecticide or fungicide products that you would have liked to use if they had been registered for application on APPLES in 2005

35 What are the herbicide, insecticide and fungicide products that were NOT registered for use on APPLES in 2005 that you would have liked to use if they had been registered in your province?

► *List chemical products that are available in other provinces or countries.*
► *If necessary, use the comment box on page 8 to provide further details or explanations.*

(If available, enter PCP number or product code found in the Interviewer Reference Guide.)

Product name 905 ○ **None** ► *Go to question 36.*

1		906	907
2		908	909
3		910	911
4		912	913
5		914	915

5-5100-462-1

STEP 7: Questions about the characteristics of the operator(s) and agricultural operation as of December 31, 2005.

36 Which of the following best describes this farm operation? 918

(Check one circle only.)

(If the operation is a family or hobby farm, check 1, 2 or 3).

01 ○ **Sole proprietorship**
02 ○ **Corporation (Limited company)**
03 ○ **Partnership**
04 ○ **Cooperative or communal operation (e.g., Hutterite colony)**
05 ○ **Other, specify:** _____ 917

37 Are you the person who looked after the day-to-day crop management decisions on this operation? 918 **Yes** ○ 01 **No** ○ 02

38 How many operators (decision-makers) 18 years of age and over were responsible for this operation? 919

39 What was the age of:

If there was only one operator, enter the age in the box for Operator 1.

1 **Operator 1?** 920

2 **Operator 2** *(minimum age 18)*? 921

40 What is the highest level of education completed by the operator(s)?

If there was only one operator, enter the level of education in the box for the Operator 1.	922 Operator 1	923 Operator 2
1 **Some elementary or secondary** *(high)* **school** *(include upgraded and special education)*	○ 01	○ 01
2 **Completed secondary (high) school** *(graduation certificate or equivalent)*	○ 02	○ 02
3 **Some post-secondary, including some college or university courses**	○ 03	○ 03
4 **Completed college or university certificate or diploma below bachelor level** *(e.g., trade, technical or vocational school, agricultural diploma, business or community college, CEGEP)*	○ 04	○ 04
5 **Completed university degree program** *(include bachelor's degree and above)*	○ 05	○ 05

41 How many years has the most experienced operator on this farm managed a farm business? 924

STEP 8: Agreement to share data

Thank you for taking the time to participate in our survey. In order to avoid duplication, Statistics Canada has entered into a data sharing agreement under Section 12 of the Statistics Act with the three federal government departments listed below to share the responses from this survey. The agreement requires that no names or addresses or any other identifier be shared with these departments and that the information be kept confidential and used only for statistical and research purposes by these three departments.

42 Do you agree to share this information with:

a) **Agriculture and Agri-Food Canada?** ..... **Yes** ○ 01 **No** ○ 02 925
b) **Health Canada?** ..... **Yes** ○ 01 **No** ○ 02 926
c) **Environment Canada?** ..... **Yes** ○ 01 **No** ○ 02 927

In order to extend the research capabilities of this survey, Statistics Canada intends to combine the information from this survey with the 2005 Fruit and Vegetables Survey information that Statistics Canada obtained from your operation.

43 Do you agree that Statistics Canada combines information from this survey with the information you provided on the 2005 Fruit and Vegetables Survey? ..... **Yes** ○ 01 **No** ○ 02 928

44 Would you like to receive a summary report of the survey results? ..... **Yes** ○ 01 **No** ○ 02 931

If "YES" continue to Question 45. If "NO" → Go to Step 9

45 What is your e-mail (or mailing) address? Your address will NOT be shared with any other government department.

Enter "MAIL" if the respondent prefers to receive the report by mail.

E-mail address 932

Agriculture and Rural Working Paper Series

(* The *Agriculture and Rural Working Paper Series* is now available on Statistics Canada's Web Site (www.statcan.ca). From the Statistics Canada *Home* page, select *Publications* and then choose *Free internet publications*.

No.1	(21-601-MPE1980001)	**A Description of Theil's RMPSE Method in Agricultural Statistical Forecasts (1980)**, Stuart Pursey
No.3	(21-601-MPE1981003)	**A Review of the Livestock Estimating Project with Recommendations for the Future (1981)**, Bernard Rosien and Elizabeth Leckie
No.4	(21-601-MPE1984004)	**An Overview of the Canadian Oilseed Industry (1984)**, Glenn Lennox
No.5	(21-601-MPE1984005)	**Preliminary Analysis of the Contribution of Direct Government Payments to Realized Net Farm Income (1984)**, Lambert Gauthier
No.6	(21-601-MPE1984006)	**Characteristics of Farm Entrants and their Enterprises in Southern Ontario for the Years 1966 to 1976 (1984)**, Jean B. Down
No.7	(21-601-MPE1984007)	**A Summary of Commodity Programs in the United States (1984)**, Allister Hickson
No.8	(21-601-MPE1984008)	**Prairie Summerfallow Intensity: An Analysis of 1981 Census Data (1984)**, Les Macartney
No.9	(21-601-MPE1985009)	**The Changing Profile of the Canadian Pig Sector (1985)**, Mike Shumsky
No.10	(21-601-MPE1986010)	**Revisions to the Treatment of Imputed House Rents in the Canadian Farm Accounts, 1926-1979 (1986)**, Mike Trant
No.11	(21-601-MPE1992011)	**The Ratio Estimator: an Intuitive Explanation and Its Use in Estimating Agriculture Variables (1992)**, François maranda and Stuart Pursey
No.12	(21-601-MPE1991012)	**The Impact of Geographic Distortion Due to the Headquarters Rule (1991)**, Rick Burroughs
No.13	(21-601-MPE1991013)	**The Quality of Agriculture Data - Strengths and Weaknesses (1991)**, Stuart Pursey
No.14	(21-601-MPE1992014)	**Alternative Frameworks for Rural Data (1992)**, A.M. Fuller, Derek Cook and Dr. John Fitzsimons
No.15	(21-601-MPE1993015)	**Trends and Characteristics of Rural and Small Town Canada (1993)**, Brian Bigs, Ray Bollman and Michael McNames
No.16	(21-601-MPE1992016)	**The Microdynamics and Farm Family Economics of Structural Change in Agriculture (1992)**, Phil Ehrensaft and Ray Bollman
No.17	(21-601-MPE1993017)	**Grains and Oilseeds Consumption by Livestock and Poultry, Canada and Provinces 1992**, Livestock and Animal Products Section
No.18	(21-601-MPE1994018)	**Trends and Patterns of Agricultural Structural Change: Canada / US Comparison**, Ray Bollman, Leslie A. Whitener and Fu Lai Tung
No.19	(21-601-MPE1994019)	**Farm Family Total Income by Farm Type, Region and Size for 1990 (1994)**, Saiyed Rizvi, David Culver, Lina Di Piétro and Kim O'Connor
No.20	(21-601-MPE1991020)	**Adjustment in Canadian Agriculture (1994)**, George McLaughlin
No.21	(21-601-MPE1993021)	**Microdynamics of Farm Size Growth and Decline: A Canada-United States Comparison**, Fred Gale and Stuart Pursey
No.22	(21-601-MPE1992022)	**The Structures of Agricultural Household Earnings in North America: Positioning for Trade Liberalization**, Leonard Apedaile, Charles Barnard, Ray Bollman and Blaine Calkins
No.23	(21-601-MPE1992023)	**Potatoes: A Comparison of Canada/USA Structure**, Glenn Zepp, Charles Plummer and Barbara McLaughlin
No.24	(21-601-MPE1994024)	**Farm Structure Data: A US-Canadian Comparative Review**, Victor J. Oliveira, Leslie A. Whitener and Ray Bollman
No.25	(21-601-MPE1994025)	**Grain Marketing Statistics Statistical Methods Working Paper Version 2**, Karen Gray

Agriculture and Rural Working Paper Series (continued)

(* The *Agriculture and Rural Working Paper Series* is now available on Statistics Canada's Web Site (www.statcan.ca). From the Statistics Canada *Home* page, select *Publications* and then choose *Free internet publications*.

No.26	(21-601-MPE1994026)	**Farm Business Performance: Estimates from the Whole Farm Database**, W. Steven Danford
No.27	(21-601-MPE1994027)	**An Attempt to Measure Rural Tourism Employment**, Brian Biggs
No.28*	(21-601-MIE1995028)	**Delineation of the Canadian Agricultural Ecumene for 1991**, Timothy J. Werschler
No.29	(21-601-MPE1995029)	**Mapping the Diversity of Rural Economies: A preliminary Typology of Rural Canada**, Liz Hawkins
No.30*	(21-601-MIE1996030)	**Structure and Trends of Rural Employment: Canada in the Context of OECD Countries**, Ron Cunningham and Ray D. Bollman
No.31*	(21-601-MIE1996031)	**A New Approach to Non-CMA/CA Areas**, Linda Howatson-Leo and Louise Earl
No.32	(21-601-MPE1996032)	**Employment in Agriculture and Closely Related Industries in Rural Areas: Structure and Change 1981-1991**, Sylvain Cloutier
No.33*	(21-601-MIE1998033)	**Hobby Farming - For Pleasure or Profit?**, Stephen Boyd
No.34*	(21-601-MIE1998034)	**Utilization of Document Imaging Technology by the 1996 Canadian Census of Agriculture**, Mel Jones and Ivan Green
No.35*	(21-601-MIE1998035)	**Employment Patterns in the Non-Metro Workforce**, Robert Mendelson
No.36*	(21-601-MIE1998036)	**Rural and Small Town Population is Growing in the 1990s**, Robert Mendelson and Ray D. Bollman
No.37*	(21-601-MIE1998037)	**The Composition of Business Establishments in Smaller and Larger Communities in Canada**, Robert Mendelson
No.38*	(21-601-MIE1998038)	**Off-farm Work by Census-farm Operators: An Overview of Structure and Mobility Patterns**, Michael Swidinsky, Wayne Howard and Alfons Weersink
No.39*	(21-601-MIE1999039)	**Human Capital and Rural Development: What Are the Linkages?**, Ray D. Bollman
No.40*	(21-601-MIE1999040)	**Computer Use and Internet Use by Members of Rural Households**, Margaret Thompson-James
No.41*	(21-601-MIE1999041)	**RRSP Contributions by Canadian Farm Producers in 1994**, Marco Morin
No.42*	(21-601-MIE1999042)	**Integration of Administrative Data with Survey and Census Data**, Michael Trant and Patricia Whitridge
No.43*	(21-601-MIE2001043)	**The Dynamics of Income and Employment in Rural Canada: The Risk of Poverty and Exclusion**, Esperanza Vera-Toscano, Euan Phimister and Alfons Weersink
No.44*	(21-601-MIE2001044)	**Rural Youth Migration Between 1971 and 1996**, Juno Tremblay
No.45*	(21-601-MIE2001045)	**Measuring Economic Well-Being of Rural Canadians Using Income Indicators**, Carlo Rupnik, Margaret Thompson-James and Ray D. Bollman
No.46*	(21-601-MIE2001046)	**The Geographical Patterns of Socio-Economic Well-Being of First Nations Communities in Canada**, Robin P. Armstrong
No.47*	(21-601-MIE2001047)	**Distribution and Concentration of Canadian Livestock**, Martin S. Beaulieu
No.48*	(21-601-MIE2001048)	**Intensive Livestock Farming: Does Farm Size Matter?**, Martin S. Beaulieu
No.49*	(21-601-MIE2001049)	**Agriculture Statistics for Rural Development**, Ray D. Bollman
No.50*	(21-601-MIE2001050)	**Rural and Small Town Employment: Structure by Industry**, Roland Beshiri and Ray D. Bollman

Agriculture and Rural Working Paper Series (continued)

(* The *Agriculture and Rural Working Paper Series* is now available on Statistics Canada's Web Site (www.statcan.ca). From the Statistics Canada *Home* page, select *Publications* and then choose *Free internet publications*.

No.51*	(21-601-MIE2001051)	**Working Time: How do Farmers Juggle with it and How has it Impacted Their Family Total Income**, Sylvain Cloutier
No.52*	(21-601-MIE2001052)	**Growers of Genetically Modified Grain Corn and Soybeans in Quebec and Ontario: A Profile**, Bernard Hategekimana
No.53*	(21-601-MIE2002053)	**Integration of Canadian and U.S. Cattle Markets**, Rita Athwal
No.54*	(21-601-MIE2002054)	**Genetically Modified Grain Corn and Soybeans in Quebec and Ontario in 2000 and 2001**, Bernard Hategekimana
No.55*	(21-601-MIE2002055)	**Recent Migration Patterns in Rural and Small Town Canada**, Neil Rothwell et al
No.56*	(21-601-MIE2002056)	**Performance in the Food Retailing Segment of the Agri-Food Chain**, David Smith and Michael Trant
No.57*	(21-601-MIE2002057)	**Financial Characteristics of Acquired Firms in the Canadian Food Industry**, Martin S. Beaulieu
No.58*	(21-601-MIE2002058)	**Provincial Trade Patterns**, Marjorie Page
No.59*	(21-601-MIE2002059)	**An Analysis of Profits within the Canadian Food Processing Sector**, Rick Burroughs and Deborah Harper
No.60*	(21-601-MIE2002060)	**Rural Diversification**, Marjorie L. Page
No.61*	(21-601-MIE2002061)	**Definitions of "Rural"**, Valerie du Plessie et al
No.62*	(21-601-MIE2003062)	**A Geographic Profile of Canadian Livestock**, Martin S. Beaulieu and Frédéric Bédard
No.63*	(21-601-MIE2003063)	**Sub-provincial Income Disparity in Canada: Evidence from 1992 to 1999**, Alessandro Alasia
No.64*	(21-601-MIE2003064)	**Canada – Mexico Agricultural Economies and Trade Under Closer North American Relations**, Verna Mitura et al
No.65*	(21-601-MIE2003065)	**Computer Technology Adoption by Canadian Farm Businesses: An Analysis Based on the 2001 Census of Agriculture**, Jean Bosco Sabuhoro and Patti Wunsch
No.66*	(21-601-MIE2004066)	**Factors Associated with Household Internet Use in Canada**, Vik Singh
No.67*	(21-601-MIE2004067)	**Mapping the Socio-Economic Diversity of Rural Canada: A Multivariate Analysis**, Alessandro Alasia
No.68*	(21-601-MIE2004068)	**The Effect of FDI on Agriculture and Food Trade: An Empirical Analysis**, W.H. Furtan and J.J. Holzman
No.69*	(21-601-MIE2004069)	**Canada's Beef Cattle Sector and the Impact of BSE on Farm Family Income**, Verna Mitura and Lina Di Piétro
No.70*	(21-601-MIE2004070)	**Measuring Industry Concentration in Canada's Food Processing Sectors**, Darryl Harrison and James Rude
No.71*	(21-601-MIE2004071)	**Trends in Non-farm Self-employment Activity for Rural Women**, Valerie du Plessis
No.72*	(21-601-MIE2004072)	**The Redesign of the Canadian Farm Product Price Index**, Andy Baldwin
No.73*	(21-601-MIE2005073)	**Effect of Urbanization on the Adoption of Environmental Management Systems in Canadian Agriculture**, Udith Jayasinghe-Mudalige, Alfons Weersink, Brady Deaton, Martin Beaulieu and Mike Trant
No.74*	(21-601-MIE2005074)	**Factors Leading to the Implementation of Beneficial Management Practices for Manure Management on Canadian Hog Operations**, Diep Le and Martin S. Beaulieu

Agriculture and Rural Working Paper Series (concluded)

(* The *Agriculture and Rural Working Paper Series* is now available on Statistics Canada's Web Site (www.statcan.ca). From the Statistics Canada *Home* page, select *Publications* and then choose *Free internet publications*.

No.75*	(21-601-MIE2005075)	**The Competitiveness of Canada's Poultry Processing Industry**, Hao Liu et al
No.76*	(21-601-MIE2005076)	**Skills, Innovation and Growth: Key Issues for Rural and Territorial Development – A Survey of the Literature**, Alessandro Alasia
No.77*	(21-601-MIE2006077)	**A Geographical Profile of Manure Production in Canada, 2001**, Nancy Hofmann and Martin S. Beaulieu
No.78*	(21-601-MIE2006078)	**Factors Affecting Biotechnology Innovation in Canada: Analysis of the 2001 Biotechnology Use and Development Survey**, Daryl van Moorsel, J.A.L. Cranfield and David Sparling
No.79*	(21-601-MIE2006079)	**An Analysis of Financing Innovation and Commercialization in Canada's Functional Food and Nutraceutical Sector**, John Cranfield, Deepananda Herath, Spencer Henson and Dave Sparling
No.80*	(21-601-MIE2006080)	**Impact of Characteristics of the Farmers and their Business on Profitability in the Canadian Hog Industry**, Véronique Maltais
No.81*	(21-601-MIE2006081)	**The Demographic Overlap of Agriculture and Rural**, Ray D. Bollman
No.82*	(21-601-MIE2006082)	**Northern Ontario's Communities: Economic Diversification, Specialization and Growth**, Ray D. Bollman, Roland Beshiri and Verna Mitura
No.83*	(21-601-MIE2007083)	**Factors Driving Canada's Rural Economy**, Ray D. Bollman
No.84*	(21-601-MIE2007084)	**Risk Factors Associated with Farm Injuries in Canada**, Véronique Maltais
No.85*	(21-601-MIE2007085)	**Off-farm Labour Decisions of Canadian Farm Operators in 2001: The Role of Operator, Farm, Community and Regional Determinants**, Alessandro Alasia, Ray D. Bollman, Alfons Weersink and John Cranfield
No.87*	(21-601-MIE2007087)	**Estimation of Water Use in Canadian Agriculture in 2001**, Martin S. Beaulieu, Caroline Fric and François Soulard
No.88*	(21-601-MIE2007088)	**An Index of Community Vulnerability: Conceptual Framework and Application to Population and Employment Changes**, Alessandro Alasia, Ray Bollman, John Parkins and Bill Reimer